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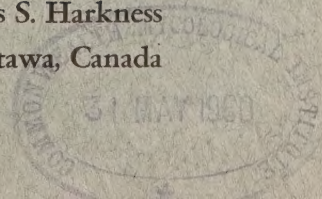
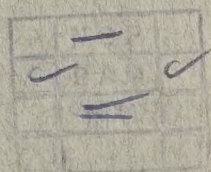
ANNUAL REPORT
of the
FOREST INSECT AND
DISEASE SURVEY

FOREST BIOLOGY DIVISION

1959

Published on the Authority of the Hon. Douglas S. Harkness
Minister of Agriculture

Ottawa, Canada





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FOREWORD

In 1959 the Forest Insect and Disease Survey enjoyed a busy and satisfactory year. The major organizational changes and some of the general trends in insect and disease problems are discussed briefly below.

Organizational changes included the recognition of the Newfoundland Survey as a separate functional unit. Although the Corner Brook Laboratory has functioned independently for several years, its contribution to this Report has been consolidated with that of the Fredericton Laboratory. The amount of information available, the complete separation of the operations, and the continuity in staff during the past year led to the conclusion that the observations for both the insect and disease aspects of the Newfoundland Survey should now appear as an independent section. The Newfoundland Survey also benefited from an additional ranger and the completion of extensive renovations to the laboratory building. More office space, controlled-rearing rooms, and cold-storage facilities are now available. Improved rearing and storage facilities were also obtained at Quebec with the completion of the new Forest Research Laboratory. At the Vernon Laboratory, special cold-room facilities have been installed. Field operations were improved by the erection of a ranger cabin at Lac La Biche, Alberta, and the relocation of the Lakelse Lake cabin in Terrace, B.C.

Authorship of the sections of this Report reflects a number of changes in senior staff members during the past year. After a period of training and the completion of graduate work, G. B. Ouellette has assumed the responsibility for certain aspects of the Disease Survey in Quebec. The Maple Laboratory regained its complement of two Survey research officers with the appointment of H. D. Griffin. At Sault Ste. Marie, a reorganization of existing staff withdrew D. R. Wallace and W. Y. Watson from the Survey to devote full time to detailed taxonomic and biological studies of *Neodiprion* sawflies. Their previous responsibilities were assumed by A. H. Rose. At the Victoria Laboratory, D. K. Edwards transferred to the Bioclimatology Section, and J. W. E. Harris joined the Survey staff.

In contrast to the unusual weather conditions of 1958, whose delayed effects are still being reported in Manitoba and British Columbia, the 1959 season produced few extremes with widespread effects on tree growth and vigor. The most generally reported condition was winter drying of conifers and winter mortality of shrubs and ornamentals. Observations in Alberta have indicated a relationship between late spring frosts and the leafing-out habit of certain clones as an explanation for the unusual 'clumping' of aspen foliage that has been quite general.

The Dutch elm disease has attracted much attention in eastern Canada and its progress has been followed closely. During 1959 its known range has been extended farther north in Ontario, while in Quebec the disease continues to affect trees throughout the range of elm. The discovery of the Dutch elm disease in New Brunswick in 1957 has been followed by intensive surveys. The disease was found more widely in 1959 but still restricted to the same three counties in west-central New Brunswick.

Spruce budworm outbreaks continue to be a serious problem in all regions except Newfoundland where the downward trend of the past few years continued and only small numbers of larvae were collected. The outbreak in northern New Brunswick and the Gaspé Peninsula further declined to a very low level

except for a few small restricted areas. However, in central New Brunswick, a definite resurgence occurred and further aerial spraying is planned for 1960. The very large long-term outbreak in northwestern Ontario and eastern Manitoba also declined markedly except for a southwestern section. Other outbreaks in northern Ontario and in Manitoba and Saskatchewan showed little change. Special life history studies were initiated in 1959 in the budworm outbreak along the MacKenzie River in the Northwest Territories. A marked reduction in intensity was recorded in contrast with the sharp increases in abundance observed along the Liard River from where it joins the MacKenzie to Mile 540 on the Alaska Highway in northern British Columbia. The extremely severe two-year-cycle budworm outbreak near Babine Lake in British Columbia continued at a very high level and severe defoliation is predicted for 1960. Outbreaks in southern British Columbia have subsided.

The progressive eastward spread of larch sawfly outbreaks in eastern Canada continued in 1959 and the distinct outbreaks in Newfoundland and Nova Scotia persisted. An increased number of larch sawfly collections were made in northwestern New Brunswick in 1959. This represents the eastern limit of virtually continuous outbreak conditions extending throughout the range of tamarack as far as northwestern British Columbia. Marked increases were reported in eastern and central Quebec, while moderate to severe defoliation continued in western Quebec and northern Ontario. In northwestern Ontario, Manitoba, and southern Saskatchewan where the larch sawfly has been in outbreak numbers for many years, the population level increased sharply following a steady decline in recent years. The most severe defoliation remains north of the Churchill River in Manitoba and Saskatchewan, and north and east of Lesser Slave Lake in Alberta; light to moderate defoliation of tamarack was common elsewhere in Alberta and in northwestern British Columbia.

Some insect conditions of regional significance that merit special mention were: progress in the establishment of balsam woolly aphid predators in Newfoundland and New Brunswick and the increased range of and mortality caused by this foreign pest in British Columbia; the recovery of introduced parasites from the winter moth at Bridgewater, N.S.; severe forest tent caterpillar defoliation in the Cypress Hills, Sask.; extensive defoliation of aspen in Alberta by the Bruce spanworm and several leaf rollers; and the marked increases in black-headed budworm numbers on the Queen Charlotte Islands where about 30,000 acres may have to be sprayed in 1960.

The diversity of problems in the Forest Insect and Disease Survey and in the research interests of Survey officers is illustrated by the following list of articles published during 1959 in scientific journals and in the Bi-Monthly Progress Report of the Forest Biology Division. Regional Forest Biology laboratories also prepare for distribution to interested parties, a variety of interim and annual reports covering insect and disease conditions in more detail. Copies of these reports or of the papers listed below may be obtained from the undersigned or from regional laboratories.

Brown, C. E. Dispersal of the pine needle scale, *Phenacaspis pinifoliae* (Fitch). Can. Ent. 90: 685-690. 1958.

Brown, C. E. Reproduction of the pine needle scale, *Phenacaspis pinifoliae* (Fitch). Can. Ent. 91: 529-535. 1959.

Cottrell, C. B. A brief history of the poplar and willow borer, *Sternonchelus lapathi* (L.) in British Columbia. Proc. Ent. Soc. B.C. 56: 46-48. 1959.

Cuming, F. G., J. A. Muldrew, and R. S. Forbes. Larch sawfly in the Maritime Provinces. Bi-Monthly Progress Report 15 (2). 1959.

Cumming, M. E. P. The biology of *Adelges cooleyi* (Gill.). Can. Ent. 91: 601-617. 1959.

Eidt, D. C. Larch shoot moth. Bi-Monthly Progress Report 15 (3). 1959.

- Finnegan, R. J., H. G. McPhee, and W. Y. Watson. An ambrosia beetle, *Corthylus punctatissimus* Zimm., attacking maple regeneration. Bi-Monthly Progress Report 15 (5). 1959.
- Grant, J. Observations on a pine shoot moth, *Eucosma sonomana* Kft. Proc. Ent. Soc. B.C. 55: 26. 1958.
- Harvey, J. K. An improved technique for pinning, spreading, and mounting minute Lepidoptera. Proc. Ent. Soc. B.C. 56: 19-20. 1959.
- Hildahl, V. and W. A. Reeks. Outbreaks of the forest tent caterpillar, *Malacosoma disstria* Hbn., and their effects on stands of trembling aspen in Manitoba and Saskatchewan. Can. Ent. (in press).
- Ives, W. G. H. and R. M. Prentice. Estimation of parasitism of larch sawfly cocoons by *Bessa harveyi* Tnsd. in survey collections. Can. Ent. 91: 496-500. 1959.
- Lindquist, O. H. and W. L. Sippell. New distribution records and notes on an arborvitae leaf-miner in Ontario. Bi-Monthly Progress Report 15 (4). 1959.
- Lindquist, O. H. A species of *Pristiphora* on spruce in Ontario. Bi-Monthly Progress Report 15 (5). 1959.
- Lindquist, O. H. A key to the larvae of leaf-mining sawflies on birch in Ontario with notes on their biology. Can. Ent. 91: 625-627. 1959.
- Martin, J. L. *Rhyacionia adana* Heinrich, a pine tip moth in Ontario. Bi-Monthly Progress Report 15 (3). 1959.
- Martineau, R. La tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana* (Clem.)) dans la Province de Québec—1939-58. Ann. Rept. Corp. Ing. For. Prov. Qué. 1958.
- Martineau, R. On an infestation of the red-headed jack pine sawfly, *Neodiprion virginianus* complex in Quebec. Bi-Monthly Progress Report 15 (5). 1959.
- McGugan, B. M. The Canadian forest insect survey. Proc. X Int. Congr. Ent. 4: 219-232. 1958.
- McMinn, R. C. and A. C. Molnar. Further observations on pole blight and climate. Bi-Monthly Progress Report 15 (1). 1959.
- Melvin, J. C. and R. M. Prentice. A predator of the cottony maple scale. Bi-Monthly Progress Report 15 (5). 1959.
- Molnar, A. C. and G. T. Silver. Build-up of *Pullularia pullulans* (de Bary) Berkhout within a severe spruce budworm infestation at Babine Lake, British Columbia. For. Chron. 35: 227-231. 1959.
- Prentice R. M. and W. A. Reeks. A localized outbreak of the cottony maple scale (*Pulvinaria innumerabilis* (Rathv.)) in Manitoba. Bi-Monthly Progress Report 15 (3). 1959.
- Prentice, R. M. and A. E. Campbell. Volume loss of pulpwood in Manitoba caused by wood borers. For. Chron. 35: 142-145. 1959.
- Ross, D. A. The maple leaf cutter, *Paraclemensia acerifoliella* (Fitch), descriptions of stages. Can. Ent. 90: 541-555. 1958.
- Ross, D. A. A list of cone and seed insects of interior British Columbia. Proc. Ent. Soc. B.C. 55: 30-31. 1958.
- Ross, D. A. and D. Evans. Annotated list of forest insects of British Columbia. Part VIII —*Semiothisa* spp. Proc. Ent. Soc. B.C. 55: 40-41. 1958.
- Ross, D. A. Abdominal characters of *Dioryctria* pupae from British Columbia. Can. Ent. 91: 731-734. 1959.
- Ross, D. A. and D. Evans. Annotated list of forest insects of British Columbia Part IX—*Caripeta* spp. (Geometridae). Proc. Ent. Soc. B.C. 56: 15. 1959.
- Ruppel, D. H. A brief history of the larch sawfly, *Pristiphora erichsonii* (Htg.), in British Columbia. Proc. Ent. Soc. B.C. 55: 32-35. 1958.
- Silver, G. T. The balsam woolly aphid, *Adelges piceae* (Ratz.), in British Columbia. Bi-Monthly Progress Report 15 (1). 1959.
- Silver, G. T. A method for sampling eggs of the black-headed budworm. J. For. 57: 203-205. 1959.
- Silver, G. T. Individual differences in estimating defoliation. Bi-Monthly Progress Report 15 (3). 1959.
- Watson, W. Y. and A. P. Arthur. Parasites of the European pine shoot moth, *Rhyacionia buoliana* (Schiff.), in Ontario. Can. Ent. 91: 478-484. 1959.
- Watson, W. Y. The larva of *Profenusa alumna* (MacG.). Can. Ent. 91: 618-625. 1959.
- Wong, H. R., J. A. Drouin, and B. B. McLeod. Observations on a 'complex' of insects in tops of black spruce in Manitoba and Saskatchewan. Can. Ent. 91: 543-548. 1959.
- Wong, H. R. and H. H. Ross. New nearctic species of the genus *Pristiphora* Latreille. Can. Ent. (in press).

- Ziller, W. G. Studies of western tree rusts. IV. *Uredinopsis hashiokai* and *U. pteridis* causing perennial needle rust of fir. Can. J. Bot. 37: 93-107. 1959.
- Ziller, W. G. Studies of western tree rusts. V. The rusts of hemlock and fir caused by *Melampsora epitea*. Can. J. Bot. 37: 109-119. 1959.

No further national compilations were published during 1959, although considerable progress was made in this direction and field work was biased to a limited degree in favour of projected compilations. In the Disease Survey, special emphasis was placed on the diseases of pine, while in the Insect Survey, chrysomelid leaf beetles and insects on spruce were given special attention. Regional laboratories made excellent progress on the compilation of data for the "Forest Lepidoptera of Canada" series and most of the information for the remaining three volumes awaits only final collation. The preparation of a comprehensive review of all biological control attempts against forest insects in Canada is being given first attention.

As always, and on behalf of the various authors, readers' comments or questions on the content and organization of this Report are welcomed.

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PROVINCE OF NEWFOUNDLAND

FOREST INSECT SURVEY

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INTRODUCTION

The balsam woolly aphid continued to be the major forest insect problem in Newfoundland although there was no extension of the boundaries defined in 1958. Larch sawfly outbreaks persisted mainly in central and western regions. Other important insects infesting coniferous trees were the black-headed budworm, the eastern hemlock looper, the spruce budmoth, the yellow-headed spruce sawfly, and the balsam-fir sawfly, all of which caused light to moderate defoliation. Browning of white birch foliage by the birch leaf-mining sawfly, the birch leaf miner, and the birch casebearer was recorded for the first time.

Special research projects included an investigation of the morphology and ecology of the balsam-fir sawfly, and a study of the impact on the larch sawfly of the shrew, *Sorex cinereus cinereus* Kerr., introduced to Newfoundland in September 1958 by the Forest Biology Division.

New parasite records were obtained for the larch sawfly, the balsam-fir sawfly and the yellow-headed spruce sawfly.

Insect collections totalled 1,054 which is about 200 more than the number received in 1958. The pulp and paper companies and the Newfoundland Forest Protection Association submitted 132 collections, miscellaneous co-operators 8, and personnel of the Forest Biology Laboratory 914. Assistance given by Anglo-Newfoundland and Development Company, Ltd., and Bowater's Pulp and Paper Mills, Ltd., in providing aircraft for aerial surveys of eastern and central Newfoundland in August and of western Newfoundland in September is gratefully acknowledged.

The distribution of collections by principal host trees was as follows:

| Coniferous Trees | Collections | Broad-leaved Trees | Collections |
|------------------|-------------|--------------------|-------------|
| Balsam fir..... | 468 | Birch..... | 54 |
| Spruce..... | 318 | Poplar..... | 54 |
| Tamarack..... | 99 | Others..... | 61 |
| Grand Total..... | | 1,054 | |

IMPORTANT INSECTS

Balsam Woolly Aphid, *Adelges piceae* (Ratz.)—The known boundaries of the balsam woolly aphid remained unchanged. Light to moderate 'stem attacks' were somewhat more widely distributed than in 1958. The 'gout' form of injury is still more common than 'stem attack' and has caused a serious general deterioration of balsam fir trees. Investigations have shown population levels of the aphid on 'gouty' trees to be low to moderate in western Newfoundland, very low on the Avalon Peninsula and moderate to high on the Burin Peninsula. Some recovery of shoot growth in leaders and topmost branches after 'gout' injury has been common in many areas during the past three years. Small swellings on these shoots indicate the presence of aphids in numbers too low to stop growth entirely; this suggests that 'recovery' may only be temporary. The extreme cold winters of 1956-57 and 1958-59 probably caused a high mortality of over-wintering aphids, thus permitting more normal shoot growth.

Tallies of 1,000 trees in 10 plots in western Newfoundland showed the following percentages of trees by classes: uninfested, 17; light to severe 'stem attack', 1; light to severe 'gout' attack, 78; and dead, 4. During the period 1951-59 the proportion of infested trees changed from 70 to 100 per cent in the Crabbies, Highlands, and Flat Bay areas, and at North Branch in a four-year period, 1955-59, 'gouty' trees increased from 1 to 38 per cent.

The program of biological control initiated in 1952 was intensified and over 40,000 insect predators were released, of which 28,965 were *Aphidoletes thompsoni* Möhn. Two predators, *Cremifania nigrocellulata* Cz. and *Leucopis* sp., were new introductions, bringing the total number of species liberated to date in Newfoundland to seven. Studies by D. G. Bryant indicate that some species released prior to 1959 appear to be established. *Laricobius erichsonii* Rosen. and *Pullus impexus* Muls. have been recovered near the release points at Wild Cove, Riverside Drive, and Frenchman's Cove and over 200 specimens of *Neoleucopis obscura* Hal. were found up to 8 miles from the release point.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)—The decline in numbers of this species that began in 1956 continued and only 71 larvae were collected from the districts of St. George's, Humber, and St. Barbe compared with 403 in 1958. No noticeable defoliation was evident and egg mass sampling was restricted to a few points in the western districts. Predictions for 1960 are that population levels will remain low.

| Reports | Collections | Larvae per tree sample | |
|---------|-------------|------------------------|----------------|
| | | Av. | Dev. from 1958 |
| 1 | 40 | 0.7 | -1.5 |

Eastern Hemlock Looper, *Lambdina fiscellaria fiscellaria* (Gn.)—There was no appreciable change in the status of the hemlock looper in 1959. Slight increases in population level were reported from eastern Newfoundland but defoliation was negligible except at Hunts Cove, Gander Lake, where it ranged from a trace to light. Fairly large moth flights were reported from the Salmonier area of the Avalon Peninsula in late summer suggesting the possibility of an incipient outbreak in 1960.

| Reports | Collections | Larvae per tree sample | |
|---------|-------------|------------------------|----------------|
| | | Av. | Dev. from 1958 |
| 5 | 64 | 1 | 0 |

Black-headed Budworm, *Acleris variana* (Fern.)—Population levels of the black-headed budworm continued to increase, particularly in the Avalon Peninsula. At the Winsor Lake Reserve and near Octagon Pond from 10 to 30 per cent of the current foliage of balsam fir trees was destroyed. This is the first record of defoliation by this species since the last series of outbreaks terminated in 1951.

| Reports | Collections | Larvae per tree sample | |
|---------|-------------|------------------------|----------------|
| | | Av. | Dev. from 1958 |
| 2 | 68 | 1.7 | +0.9 |

Balsam-fir Sawfly, *Neodiprion abietis* (Harr.)—No major change in the status of this sawfly was determined in 1959. Scattered colonies of larvae occurred on open-grown immature balsam fir trees in the George's Lake, Gallants, and Grand Lake areas (see map). Defoliation was generally low, not exceeding 10 per cent at any location. Natural parasitism has been high during the past two years and probably accounts for the current low population levels. A virus disease caused about 6 per cent mortality of larvae reared in the insectary.

| Reports | Collections | Larvae per tree sample | |
|---------|-------------|------------------------|----------------|
| | | Av. | Dev. from 1958 |
| 3 | 222 | 10 | 0 |

Spruce Bud Moth, *Zeiraphera ratzeburgiana* Ratz.—This insect occurred in association with the spruce budworm on white spruce trees throughout the western region of the Province from Doyles to Bellburns, and with the black-headed budworm on the Avalon Peninsula. Loss of the current year's foliage was estimated at 10 to 20 per cent. Higher numbers in the St. Fintans-Highlands area caused defoliation up to 30 per cent.

| Reports | Collections | Larvae per tree sample | |
|---------|-------------|------------------------|--|
| | | Av. | |
| 2 | 51 | 5.5 | |

Spruce Coneworm, *Dioryctria reniculella* (Grote)—Small numbers were found in association with the spruce budworm throughout St. George's District but foliage loss was negligible.

| Collections |
|-------------|
| 14 |

European Spruce Sawfly, *Diprion hercyniae* (Htg.)—There was an increase in spruce sawfly population levels in western areas. Throughout the Upper Humber Watershed and on the Baie Verte Peninsula larvae were common on both black and white spruce. Collections of 25 larvae per tree sample were made along the Serpentine Lake Road. Loss of foliage was estimated to be less than 5 per cent. Larval mortality in collections received was about 15 per cent and mortality of larvae reared was almost 50 per cent. All of the dead specimens showed symptoms of a virus disease indicating that the virus introduced to Newfoundland in 1948 is still a valuable control factor.

| Reports | Collections | Larvae per tree sample | |
|---------|-------------|------------------------|----------------|
| | | Av. | Dev. from 1958 |
| 0 | 134 | 2.0 | +0.7 |

Yellow-headed Spruce Sawfly, *Pikonema alaskensis* (Roh.)—Large collections of this sawfly were taken from young black spruce trees in the Upper Humber River Watershed and at Pinsent's Ridge, Terra Nova (see accompanying map). Loss of foliage generally ranged from 5 to 15 per cent in the Upper Humber area, although in a few cases it was as high as 90 per cent, and from 20 to 50 per cent near Terra Nova. This is the fifth consecutive year that defoliation has been recorded in the latter area and some trees are dying. This sawfly was common throughout other black spruce stands, although defoliation was negligible. Larval parasitism was high in 1959, particularly in the Terra Nova area.

| Reports | Collections | Larvae per tree sample | |
|---------|-------------|------------------------|----------------|
| | | Av. | Dev. from 1958 |
| 1 | 98 | 4.5 | -1.7 |

Green-headed Spruce Sawfly, *Pikonema dimmockii* (Cress.)—This species was common on spruce trees throughout the Province but numbers were generally low and no foliage loss was apparent.

| Collections |
|-------------|
| 79 |

Larch Sawfly, *Pristiphora erichsonii* (Htg.)—Extensive outbreaks of the larch sawfly persisted in western Newfoundland near St. George's and Corner Brook, and localized outbreaks occurred in the districts of Gander, Green Bay, Grand Falls, Bonavista South, and Fortune (see map). Defoliation of tamarack ranged from 30 to 90 per cent, being most severe in western Newfoundland and

in the Bay d'Espoir, Upper Gander River, and Halls Bay areas. Defoliation in other tamarack stands was less than 10 per cent. This is the sixth consecutive year that severe outbreaks have been recorded.

| Reports | Collections | Larvae per tree sample | |
|---------|-------------|------------------------|----------------|
| | | Av. | Dev. from 1958 |
| 3 | 44 | 10 | -18.4 |

Larch Casebearer, *Coleophora laricella* (Hbn.)—Twig sampling for the larch casebearer was carried out at selected stations and light browning of tamarack foliage occurred on the Baie Verte Peninsula. Elsewhere population levels remained low.

| Reports | Collections |
|---------|-------------|
| 0 | 18 |

Satin Moth, *Stilpnotia salicis* (L.)—Large numbers of larvae were collected from Lombardy poplars in the town of Deer Lake for the seventh consecutive year. No other collections were made and outbreaks which persisted in central Newfoundland from 1952 to 1957 have apparently subsided. No collections were made in natural stands of trembling aspen as in 1956.

| Reports | Collections |
|---------|-------------|
| 2 | 7 |

Birch Casebearer, *Coleophora fuscedinella* (Zell.)—A severe, but localized, outbreak occurred on white and yellow birch and alder between Stephenville Crossing and White's Farm. Browning of foliage from larval feeding ranged from 30 to 60 per cent. This species was first recorded in Newfoundland in 1954 and has since been collected in the Doyles to Bonne Bay area and on the Bonavista Peninsula.

| Collections |
|-------------|
| 3 |

Birch Leaf-mining Sawfly, *Heterarthrus nemoratus* (Fall.) and **Birch Leaf Miner**, *Fenusa pusilla* (Lep.)—Varying degrees of browning of the foliage of young white birch trees was observed in central and eastern Newfoundland from Cormack to Clarenville, including the Bonavista Peninsula. Defoliation up to 50 per cent was recorded between Bishop's Falls and Gander where attack was most severe. This is the first record of injury by these species in the Province although they have been present for some time.

Poplar Leaf Roller, *Anacampsis innocuella* Zell.—The outbreak which caused severe defoliation of trembling aspen trees in central and eastern Newfoundland in 1957 and in 1958 subsided in 1959, although light defoliation occurred near Gander and Glovertown.

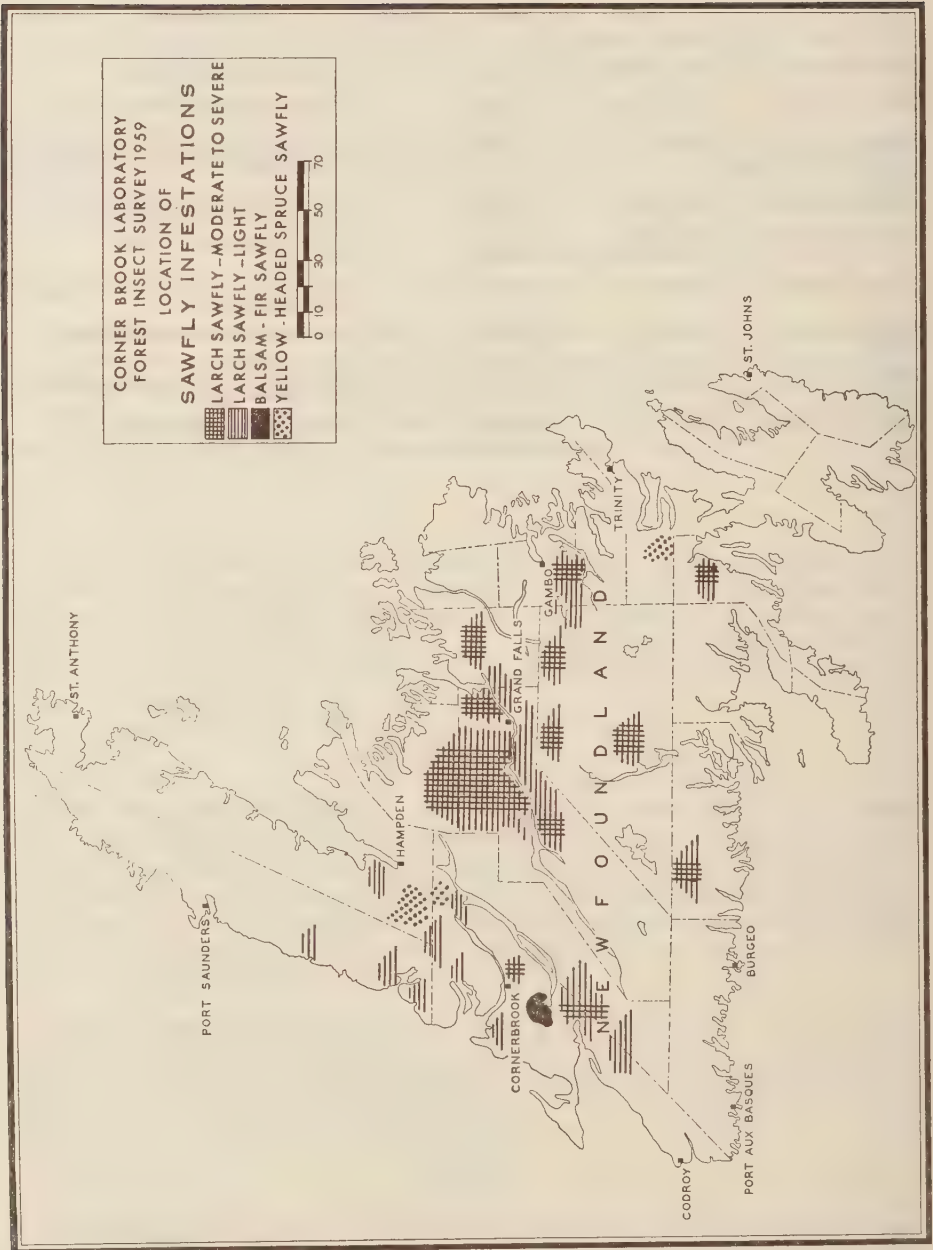
| Collections |
|-------------|
| 10 |

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.)—Damage was observed from Gambo to St. George's. Complete defoliation of scattered trees was recorded at many locations.

| Collections |
|-------------|
| 4 |

OTHER NOTEWORTHY INSECTS

| Species | Host | Region | Number Collected | Remarks |
|---|-------------------------------|------------------|------------------|--|
| <i>Adelges abietis</i> (L.) | Spruce, white | Western | 3 | Less numerous than in 1958. |
| <i>Altica ambiens</i> (Lec.) | Willow; aspen; alder | Western, central | 651 | First record of conspicuous defoliation. |
| Gall Midge, poss. <i>Dasyneura balsamicola</i> (Lint.) | Fir, balsam | Labrador | Several | First record; previously recorded in western Newfoundland. |
| <i>Hylobius</i> sp. (DeG.) | Pine, red | Western | 10 | First record of injury for this region. |
| <i>Nyctobia limitaria</i> Wlk. | Fir, balsam; spruce; tamarack | Western, central | 118 | Higher numbers than in 1958. |
| <i>Pityogenes hopkinsi</i> Sw. | Spruce, black | Western | Several | First record; on regeneration affected by Armillaria root rot. |
| <i>Pteronidea ventralis</i> (Say) | Willow | Western | 162 | First record of conspicuous defoliation. |
| <i>Scolytus piceae</i> Sw. | Spruce, black | Western | Several | First record; on regeneration affected by Armillaria root rot. |
| <i>Sternochetus lapathi</i> L. | Willow | Western | 290 | First record; on ornamentals. |



PROVINCE OF NEWFOUNDLAND

FOREST DISEASE SURVEY

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Forest Biology Laboratory, Corner Brook, Newfoundland

INTRODUCTION

During 1959, collections of forest tree diseases in Newfoundland were largely restricted to those that could not be readily diagnosed in the field. Only reports were submitted for common and easily recognized diseases. Fifty-three collections were submitted to the Forest Biology Laboratory, Fredericton, N.B., and 162 reports were received by the Corner Brook Laboratory.

The most important diseases were winter drying of conifers, *Armillaria* root rot of black spruce regeneration, needle rusts of conifers, and a premature drying of birch foliage.

IMPORTANT DISEASES

Winter Drying of Conifers—Winter drying of balsam fir was prevalent in many locations, particularly at Stag Hill, John's Beach, along the coast from Bonne Bay to Bellburns, in the Brigus-Whitbourne-Markland area, the Torbay Road, and on the Bonavista Peninsula. Severe injury occurred to ornamental red pines at St. John's and to red and Scots pine in plantations at Brigus and Catalina. At these locations, 50 to 75 per cent of the trees were damaged. Light to moderate injury was recorded in a natural stand of red pines at Grants Siding near Alexander Bay.

Armillaria Root Rot—Damage from *Armillaria mellea* (Vahl ex Fr.) Quél. to black spruce regeneration was recorded again in the Upper Humber area. Slightly more than 10 per cent of the trees were diseased or dead. Of the affected trees, less than 1 per cent showed symptoms of recent infection. This root rot is apparently widespread and has been found on young spruce trees in cut-over and burned-over areas.

Needle Rusts of Conifers—Needle rusts were heavy on the current year's foliage of both balsam fir and spruce in localized areas. Heavy infections were observed on balsam fir in the Lake St. George, Frenchman's Cove and Stag Hill areas in western Newfoundland; on white spruce at Taylor's Brook and Holyrood; and on black spruce in the following locations: King George IV Lake, Bay d'Espoir, Halls Bay Road, Main Dam, Baie Verte Road, Serpentine Road, and Birchy Road. On the basis of collections submitted, the needle rusts of spruce were caused by either *Chrysomyxa ledi* de Bary or *C. ledicola* Lagerh.

Drying of Birch Foliage—A drying out and curling of the terminal foliage of white and yellow birch occurred in mid-August for the second year in the Badger-Grand Falls area and at various locations throughout the Humber and St. George's districts. A similar condition was recorded for the first time at Swift Current on the Burin Peninsula. The cause of the disorder is not known.

¹Forest Biology Laboratory, Fredericton, N.B.

Frost Damage—Shoot killing by late frost occurred on white spruce and balsam fir in localized areas. Injury was generally light.

Needle Casts of Conifers—A yellowing or browning of the needles of conifers was observed in several localities. This discoloration suggested attack by needle cast fungi, although no fruiting bodies were observed. The condition was recorded on balsam fir on the Avalon Peninsula; on black spruce in the Gambo and Taylor's Brook areas; on white spruce at Lake St. George; and on tamarack near Corner Brook Lake. At each location, the discoloration was restricted to a small number of trees.

White-pine Blister Rust—This disease, caused by *Cronartium ribicola* J. C. Fischer was recorded wherever white pines occur in Newfoundland.

Eastern Dwarf Mistletoe—Injury to young black spruce trees by *Arceuthobium pusillum* Peck was apparent at Whetstone Point, Grand Lake, near Badger on the Badger-Buchans Road, and near Sheffield Lake. At Whetstone Point a number of trees were dead and the prevalence of the dwarf mistletoe suggested that it was an important contributing factor.

Black Knot of Cherry—Black knots, resulting from attack by *Dibetryon morbosum* (Schw.) T. & S., were common on pin cherry throughout the Province.

MARITIME PROVINCES

FOREST INSECT SURVEY

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INTRODUCTION

The spruce budworm and the larch casebearer were the most important native insects causing serious injury in 1959. The severity of spruce budworm infestations increased strikingly from 1958 throughout much of central New Brunswick, and continued to decrease in the northern and southern parts of the Province, in Nova Scotia, and in Prince Edward Island. Larch casebearer numbers decreased further in all districts of New Brunswick, and little defoliation was observed; numbers increased in Nova Scotia, causing moderate to severe browning of trees over wide areas. Introduced species of importance included the balsam woolly aphid and the winter moth; balsam fir continued to die from the effects of past infestations of the aphid and 'gout' is general throughout Nova Scotia, Prince Edward Island, and southern New Brunswick. Severe infestations have, however, been less frequent in recent years and some improvement in natural control is associated with the establishment of introduced predators. Winter moth infestations were generally less severe than in 1958 in older outbreak areas in western Nova Scotia.

New records were obtained extending the known distribution of the balsam woolly aphid, beech scale, and winter moth. A leaf roller, *Sparganothis pettitana* (Rob.), not previously reported in this Region, caused severe defoliation of red maple trees in parts of New Brunswick. Parasite records, new to the Survey in the Maritimes, were obtained for the fall cankerworm, larch shoot moth, and red-pine sawfly.

Improvements were made in certain collecting and rearing techniques and increased emphasis was given to timing samples in relation to insect and host plant development. Balsam fir shoot growth was measured periodically at a number of inland and coastal locations in an attempt to discover the magnitude of phenological differences in various areas and to ensure better timing in collecting and sampling.

Research problems within the Survey included studies of the life history and morphology of four species of Adelginae on white pine and on white spruce and red spruce, the biology of the winter moth, the biology and larval taxonomy of pamphiliid sawflies on forest trees, the biology and morphology of the larch shoot moth, and the biology of the mountain-ash sawfly.

The assistance provided by the New Brunswick Forest Service, the Nova Scotia Departments of Lands and Forests and Agriculture and Marketing, the Forestry and Parks Branches, Department of Northern Affairs and National Resources, Forest Protection Ltd., and pulp and paper companies is greatly appreciated.

¹Forest Biology Laboratory, Truro, Nova Scotia.

Insect collections totalled 4,095; New Brunswick, 1,829; Nova Scotia, 2,180; Prince Edward Island, 86. Special reports on insect conditions totalled 385. The numbers of collections by major tree species were as follows:

| Coniferous Trees | Collections | Broad-leaved Trees | Collections |
|-----------------------------|-------------|----------------------------|-------------|
| Balsam fir..... | 981 | Birch..... | |
| Spruce | | White birch..... | 152 |
| White spruce..... | 678 | Wire birch..... | 68 |
| Red spruce..... | 236 | Yellow birch..... | 30 |
| Black spruce..... | 4 | Miscellaneous birches..... | 14 |
| Miscellaneous spruces..... | 86 | | <hr/> |
| | 1,004 | | 264 |
| Tamarack..... | 504 | Poplar | |
| Pine | | Trembling aspen..... | 89 |
| Eastern white pine..... | 157 | Silver poplar..... | 24 |
| Jack pine..... | 22 | Largetooth aspen..... | 9 |
| Red pine..... | 17 | Balsam poplar..... | 7 |
| Scots pine..... | 7 | Carolina poplar..... | 11 |
| Miscellaneous pines..... | 1 | Miscellaneous poplars..... | 33 |
| | 204 | | <hr/> |
| Eastern white cedar..... | 27 | | 173 |
| Eastern hemlock..... | 11 | White elm..... | 57 |
| | | Maple | |
| Total..... | 2,731 | Red maple..... | 54 |
| | | Sugar maple..... | 11 |
| Miscellaneous hosts or host | | Silver maple..... | 5 |
| unspecified..... | 464 | Miscellaneous maple..... | 23 |
| | | | <hr/> |
| | | | 93 |
| | | Oak | |
| | | Red oak..... | 79 |
| | | Miscellaneous oak..... | 2 |
| | | | <hr/> |
| | | | 81 |
| | | Cherry..... | 121 |
| | | Mountain ash..... | 48 |
| | | Beech..... | 27 |
| | | Willows..... | 36 |
| | | | <hr/> |
| | | Total..... | 900 |
| Grand Total..... | 4,095 | | |

IMPORTANT INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)—The distribution and intensity of spruce budworm infestations in the Maritime Region, as determined by aerial and ground surveys, are indicated on the accompanying map. For several years budworm infestations mapped in this Report have been classified in three degrees, based primarily on the loss of new foliage of balsam fir or white spruce: severe, over 70 per cent; moderate, 30 to 60 per cent; and light, trace to 20 per cent. Although the use of these three classes is continued the map does not adequately show the diversity of infestation conditions, because of the unusually scattered and discontinuous pattern of attack in 1959. Also, some interpretation of light infestations is necessary. As noted above, traces of defoliation in past years have been included in the mapping of light infestations. This degree of attack was common in northern and southern New Brunswick in 1959, but was in most cases due to species other than the spruce budworm. The light infestations mapped in 1959 apply to areas where defoliation of new shoots ranges from 10 to 20 per cent, when it could be attributed with certainty to the spruce budworm.

The budworm situation was characterized by an unexpected increase in outbreak severity across central New Brunswick, and a continued decrease in northern and southern parts of the Province, in Nova Scotia, and in Prince Edward Island. Attacks in New Brunswick were largely confined to an east-west band across the middle of the Province (see map). Except for small areas of moderate infestation near Brockway and Thomaston Corner in York County, budworm numbers throughout the remainder of the Province were negligible. Egg sampling indicated that infestations are likely to continue in 1960 in much the same areas as in 1959, but with increased severity and uniformity.

In Nova Scotia defoliation was observed only at Ingonish Centre on Cape Breton Island, where a trace of damage occurred on the new shoots of white spruce, but some of this was caused by the yellow spruce budworm, *Zeiraphera fortuneana* Kft. Of 58 locations sampled, egg masses were found at 11 all in Victoria and Inverness counties; the small number of egg masses taken would indicate further reduction of the budworm populations in 1960.

In Prince Edward Island infestations were most severe at Poole's Corner, Stanhope, and Grand Tracadie, where from 30 to 40 per cent of the foliage on new balsam fir shoots was destroyed. Defoliation was light at Ellis River, Brackley Beach, Covehead, Pisquid, Midgell, Hopefield, Wood Islands North, and Orwell. Elsewhere the loss of foliage was negligible. Egg sampling at 42 locations indicated a continued reduction in population levels in 1960.

| | Reports | Collections | Larvae per tree sample | |
|---------------------------|---------|-------------|------------------------|----------------|
| | | | Av. | Dev. from 1958 |
| New Brunswick..... | 16 | 482 | 4.9 | -2.0 |
| Nova Scotia..... | 4 | 56 | 1.5 | -3.4 |
| Prince Edward Island..... | 9 | 20 | 0.1 | -8.4 |

Balsam Woolly Aphid, *Adelges piceae* (Ratz.)—The discovery of light to moderate 'stem attacks' of this insect by K. W. Keith, Miramichi Lumber Company, on a few balsam fir trees west of Blackville near the Dungarvon River has extended the known northern limits of the insect in New Brunswick. The balsam woolly aphid is known to occur in all counties of Nova Scotia and Prince Edward Island and has been found throughout southern New Brunswick, south of a line which extends roughly from Upper Woodstock, to McGivney, to the area west of Blackville, to Kent Junction, and east of a line between Kent Junction and Grand Anse, to include most of the Caraquet Peninsula and the Islands of Shippegan and Miscou. Infestations are generally light or scattered near this northern limit of occurrence. In older areas of outbreak, 'stem attack' is occasional and usually light, but 'gout' is general and usually severe. It has caused some mortality and serious growth losses of balsam fir trees, especially in coastal areas.

In co-operation with D. O. Greenbank, who is studying the phenology of the insect at various locations, 160 bark samples were collected from 51 locations. These samples, supported by general observations, indicated that light infestations were most common, but moderate and severe 'stem attacks' occurred in the following areas:

- New Brunswick—near Doaktown, Scotch Lake, Mount Hope, Debec, Acton, Never's Road, and Canoose River.
- Nova Scotia—Harrison Settlement, Kemptown, near Tatamagouche, Upper Musquodoboit, and Sheet Harbour.
- Prince Edward Island—Brundenell River.

Tallies on a plot at Grand Anse, N.B. showed that 95 per cent of the trees were dead from 'gout' attack. The remaining trees were severely infested and

had many dead branches. On Shippegan and Miscou Islands and in the Miramichi Bay area east of Point Gardiner, considerable mortality of trees has occurred over a number of years.

Little change was observed in eastern Nova Scotia. The number of trees with light 'stem attack' continued to increase in a plot on the plateau area of North River, Cape Breton Island.

The program of liberation and study of introduced predators included the release of small numbers of eight species of beetles from India and Pakistan and large liberations of the European predator *Aphidoletes thompsoni* Möhn. R. C. Clark reports that *A. thompsoni* is considered established where it was liberated but has not reached effective numbers. Among species established, the beetle *Laricobius erichsonii* (Rosen.) is the most promising.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 5 | 28 |
| Nova Scotia..... | 6 | 154 |
| Prince Edward Island..... | 1 | 3 |

Gall Midges on Balsam Fir Needles, *Dasyneura* sp. prob. *balsamicola* (Lint.), and an undetermined species near *Cecidomyia*—Infestations of midges on the needles of balsam fir were generally less severe in the Maritime Provinces for the second consecutive year.

In New Brunswick, observations and collections from young open-grown trees, and the examination of foliage collected from dominant and co-dominant trees in spruce budworm egg surveys at over 800 locations, showed that midge numbers were generally low. However, attacks of moderate intensity occurred about 5 miles north of St. Croix and at Charlie Lake, York County; and at Blackland, Restigouche County. Severe attacks occurred at Coldstream, Carleton County.

Numbers were generally low in the eastern part of Nova Scotia and damage was much less severe than in 1958 in parts of Colchester and Cumberland counties, especially near Castlereagh and Sutherland Lake. Attacks, ranging from light on dominant trees to severe on some reproduction, were observed from South Branch, Colchester County, south to Elmsvale and Lindsay, Halifax County. Elsewhere in Halifax County severe damage occurred near Gays River, Cooks Brook, Moose River, Porter Lake, Black Point, and St. Margaret's Bay. Severe infestations were also present at Ardoise, Hants County, and at isolated locations in Lunenburg and Queens counties.

Observations at 42 locations in Prince Edward Island did not show any evidence of attack.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 3 | 14 |
| Nova Scotia..... | 7 | 22 |
| Prince Edward Island..... | 1 | — |

Eastern Hemlock Looper, *Lambdina fiscellaria fiscellaria* (Guen.)—This insect was present on balsam fir in small numbers but no defoliation was observed.

| | Reports | Collections | Larvae per tree sample | |
|--------------------|---------|-------------|------------------------|----------------|
| | | | Av. | Dev. from 1958 |
| New Brunswick..... | 3 | 32 | 0.6 | +0.1 |
| Nova Scotia..... | 7 | 113 | 0.8 | +0.2 |

Balsam-fir Sawfly, *Neodiprion abietis* complex—For the first time since 1945, this sawfly caused appreciable defoliation on balsam fir trees in the Maritime Provinces. Two localized infestations were observed in northern Colchester County, Nova Scotia. The more severe outbreak was centred in the Londonderry

Mines-Sutherland Lake area, and extended from Glenholme, Colchester County, to Westchester Station, Cumberland County. In the centre of this outbreak, the loss of old foliage averaged about 30 per cent but some trees had lost from 70 to 100 per cent of their old needles. Defoliation was less noticeable on the periphery of the outbreak. The second outbreak covered an area of about 5 acres near East New Annan. About 20 per cent of the 1957 and 1958 foliage was destroyed. Red spruce and white spruce trees were attacked in both areas but to a lesser degree. Mortality due to a virus disease was high.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 3 | 38 |
| Nova Scotia..... | 5 | 47 |
| Prince Edward Island..... | — | 1 |

Black-headed Budworm, *Acleris variana* (Fern.)—Population levels remained low in the Maritimes in 1959.

| | Reports | Collections | Larvae per tree sample | |
|---------------------------|---------|-------------|------------------------|----------------|
| | | | Av. | Dev. from 1958 |
| New Brunswick..... | 6 | 115 | 0.8 | -0.1 |
| Nova Scotia..... | 8 | 55 | 1.1 | +0.3 |
| Prince Edward Island..... | 1 | 4 | 0.9 | -0.4 |

Balsam Shoot-boring Sawfly, *Pleroneura borealis* Felt—Light infestations on the new balsam fir shoots were noted at a few locations in Northumberland and Restigouche counties, N.B., and at Forest Glen, Yarmouth County, N.S.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 5 | 9 |
| Nova Scotia..... | 1 | 1 |

European Spruce Sawfly, *Diprion hercyniae* (Htg.)—Numbers remained low in 1959. The largest collections were taken from sampling stations in Nova Scotia at Truemanville, Colchester County, at Squirreltown, Annapolis County, and at Trafalgar, Guysborough County, where tree samples averaged 15.3, 10.0, and 9.7 larvae respectively.

The percentages of diseased larvae collected by D. E. Elgee from two plots near Fredericton have been given in this Report since 1956; also, parasitism by introduced species was mentioned in 1956 and in 1958. Improved methods of evaluating the incidence of disease and parasitism changed the values previously listed from these plots. The percentages of diseased larvae from 1956 to 1959, and parasitism to 1958, based on numbers of larvae collected in instars 4, 5, and 6 of the second generation, are now as follows:

| | Disease | | | | Parasitism | | |
|-------------|---------|------|------|------|------------|------|------|
| | 1956 | 1957 | 1958 | 1959 | 1956 | 1957 | 1958 |
| Plot 1..... | 0.0 | 6.7 | 8.9 | 34.0 | 14.0 | 21.6 | 21.0 |
| Plot 2..... | 1.9 | 23.1 | 28.6 | 43.5 | 32.1 | 25.8 | 41.0 |

Diseased larvae and small numbers of introduced parasites were collected from various parts of New Brunswick and Nova Scotia.

| | Reports | Collections | Larvae per tree sample | |
|---------------------------|---------|-------------|------------------------|----------------|
| | | | Av. | Dev. from 1958 |
| New Brunswick..... | 10 | 114 | 1.8 | +1.1 |
| Nova Scotia..... | 9 | 236 | 1.7 | +0.4 |
| Prince Edward Island..... | 1 | 7 | 1.0 | -0.5 |

Yellow-headed Spruce Sawfly, *Pikonema alaskensis* (Roh.)—Moderate to severe defoliation was observed on young, well-spaced trees in a 2-acre stand near Connors, Madawaska County, New Brunswick. Other localized infestations of similar intensity occurred in Colchester County, Nova Scotia, on red spruce reproduction at Nuttby, and on a red spruce hedge at Truro. Elsewhere numbers were low.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 6 | 44 |
| Nova Scotia..... | 6 | 65 |
| Prince Edward Island..... | 1 | 4 |

Spruce Bud Midge, *Rhabdophaga swainei* Felt—The failure of shoots to develop from buds attacked in 1958 was common in a small white spruce stand at Belledune Point, Gloucester County, New Brunswick. Similar damage was noted on occasional red spruce and white spruce trees at 10 other locations in northeastern New Brunswick.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 1 | 9 |

Yellow Spruce Budworm, *Zeiraphera fortuneana* Kft., and Spruce Bud Moth, *Zeiraphera ratzeburgiana* Ratz.—Population levels in 1958 and 1959 were compared by districts using data obtained by beating young white spruce trees at permanent sampling stations. Both species decreased in numbers in southern New Brunswick and Nova Scotia but increased in northern New Brunswick. *Z. ratzeburgiana* increased four fold in northeastern New Brunswick.

Defoliation, attributed to both species, ranged from a trace to 10 per cent at the following locations in New Brunswick: Blackville, Northumberland County; near the Sanitarium at Bathurst, Bass River Road, Six Roads, and at a point 2 miles west of Grand Anse, Gloucester County; Flatlands, and 5 miles east of Campbellton, Restigouche County; Port Elgin, Westmorland County; and near Bennett Lake, Albert County. A corresponding degree of defoliation was observed on white spruce trees near O'Leary and at Milltown, Prince Edward Island.

Except for a trace of defoliation at Ingonish Centre, by *Z. fortuneana*, no damage was observed in Nova Scotia.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 8 | 95 |
| Nova Scotia..... | 9 | 54 |
| Prince Edward Island..... | 3 | 2 |

Larch Casebearer, *Coleophora laricella* (Hbn.)—Larval counts at 79 permanent sampling stations by a sequential technique devised by F. E. Webb (Bi-Monthly Progress Report 13(4), 1957), and outlined in the 1957 Report, indicated that numbers decreased in New Brunswick and increased in Nova Scotia. Population levels of overwintering larvae and infestation classes by districts are summarized as follows:

| District | No. sampling stations | Av. no. cases per sample | Deviation from 1958 | Infestation class |
|---------------------------------|-----------------------|--------------------------|---------------------|-------------------|
| Southern New Brunswick..... | 17 | 1.2 | - 9.2 | Light |
| Northeastern New Brunswick..... | 13 | 0.2 | - 0.3 | Light |
| Northwestern New Brunswick..... | 14 | 1.4 | - 0.3 | Light |
| Eastern Nova Scotia..... | 16 | 30.1 | +19.9 | Moderate |
| Western Nova Scotia..... | 16 | 30.1 | +11.1 | Moderate |
| Prince Edward Island..... | 3 | 2.8 | * | Light |

*Sampling stations established in 1959

Traces of defoliation were observed in New Brunswick only at Green River, Madawaska County; Bartibog Bridge, Northumberland County; Six Roads and Tracadie, Gloucester County; and Little Belledune Point, Restigouche County.

Moderate to severe defoliation of tamarack stands was widespread in Nova Scotia. Defoliation as high as 90 per cent was observed in the counties of Inverness, Richmond, Colchester, Kings, Annapolis, Digby, Yarmouth, Shelburne, Queens, and Lunenburg.

Extensive collecting and rearing of casebearers from permanent sampling stations since 1956 have resulted in many recoveries of the introduced parasites, *Chrysocharis laricinellae* (Ratz.) and *Agathis pumila* (Ratz.). *C. laricinella* has been recovered from all counties except Albert, N.B., and Annapolis, N.S. *A. pumila* has yet to be collected from Albert, St. John, Kent, and Carleton counties, N.B., from Cape Breton, Richmond, Halifax, Annapolis, Kings, and Hants counties, N.S. It has not yet been collected from Prince Edward Island.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 5 | 56 |
| Nova Scotia..... | 9 | 97 |
| Prince Edward Island..... | 2 | 8 |

Larch Sawfly, *Pristiphora erichsonii* (Htg.)—The larch sawfly was collected in small numbers at 12 locations in Madawaska, Restigouche, Victoria, Carleton, and Kings Counties, N.B. Only two collections were taken in New Brunswick in 1958.

In Nova Scotia the insect was found over wider areas in the counties of Halifax, Guysborough, Colchester, and Annapolis. It was collected for the first time in many years in Kings County near Kingston, and on Cape Breton Island at Florence, Cape Breton County, and between St. Peter's and Grand Anse, Richmond County. Defoliation of tamarack was light except at Pope's Harbour, Halifax County, and near Hassett, Digby County, where it averaged 40 and 60 per cent, respectively.

The sawfly was not collected in Prince Edward Island.

J. A. Muldrew reported successful parasitism by the introduced species, *Mesoleius tenthredinis* Morley, to be 8.7 per cent of total emergence of host and parasite in collections made in Nova Scotia in 1958.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 3 | 13 |
| Nova Scotia..... | 6 | 122 |

Larch Shoot Moth, *Argyresthia loricella* Kft.—The larch shoot moth was found in small numbers throughout the Maritime Provinces. Examinations of tamarack shoots from 25 localities showed that the population level is about four larvae per 1,000 shoots. The infestation level was not higher than 10 larvae per 1,000 shoots in any locality. Leaders of young trees have been killed at Fredericton. Parasitism averaged about 66 per cent; the principal parasites were: *Apanteles loricellae* Mason, *Phaeogenes* sp., and *Pimplopterus* sp.

Parasites not previously reported in the Maritimes with years in which they were found are: *Apanteles loricellae* Mason (1957), *Pimplopterus* sp. (1958), *Alegina* sp. (1958), and *Euderus cushmani* (Cwfd.) (1959). The *Habrocytus* sp. reported in 1957 is a scavenger or hyperparasite or both.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 6 | 27 |
| Nova Scotia..... | 4 | 10 |
| Prince Edward Island..... | 1 | 3 |

Pine Leaf Chermes, *Pineus pinifoliae* (Fitch)—This insect has caused serious injury to white pine shoots in the Maritime Provinces in past odd-numbered years. Galls on red spruce shoots and gallicolae migrantes on white pine needles were common in June, and moderate to severe injury to white pine was expected. However, noticeable damage only occurred on a few shoots at Burt's Corner, York County; Boiestown and Bathurst Lake, Northumberland County; near Plaster Rock, Victoria County; and at Glazier Lake, Madawaska County in New Brunswick. The causes of this unexpected reduction are not known.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 21 | 32 |
| Nova Scotia..... | 5 | 189 |

Red-pine Sawfly, *Neodiprion nanulus nanulus* Schedl—This sawfly was collected only in New Brunswick where it caused light defoliation of a few red pine trees at Boiestown and Kirkwood, Northumberland County, and moderate defoliation of red pine trees in a plantation at the Acadia Forest Experiment Station near Fredericton. The latter infestation has continued since 1956 in varying intensities. In 1957 the following parasites, new to this host in the Maritime Provinces, were reared from sawfly cocoons: *Agrothereutes lophyri* (Nort.), *Agrothereutes* sp., *Aptesis indistincta* (Prov.), *Mastrus argeae* (Vier.), and *Endasys subclavatus* (Say). In 1958 the rearing of 9,000 sawfly larvae produced 45 specimens of the ichneumonid parasite *Lamachus lophyri* (Ashm.) and 125 specimens of *Lamachus* sp. All these parasites were identified by G. S. Walley, Entomology Research Institute, Ottawa.

Ninety per cent of the larvae were killed when 350 trees in this plantation were sprayed with a virus suspension by D. E. Elgee in 1959.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 2 | 7 |

European Pine Shoot Moth, *Rhyacionia buoliana* (Schiff.)—Red pine and jack pine trees were severely injured in a nursery at Lawrencetown, Nova Scotia. Small numbers were also collected from jack pine near Crocket Corner, Kings County, N.B., but little damage was observed.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 2 | 1 |
| Nova Scotia..... | 3 | 2 |

Pitch Nodule Maker, *Petrova albicapitana* (Busck)—Examination of branches from lodgepole pine trees at the Acadia Forest Experiment Station, N.B., showed that old nodules were numerous but recent attacks light. Red pine and jack pine trees in a nursery at Lawrencetown and red pines at Debert, N.S., supported recent attacks of light to moderate intensity.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 1 | 3 |
| Nova Scotia..... | 2 | 4 |

Birch Casebearer, *Coleophora fuscediella* (Zell.)—In New Brunswick the browning of the foliage of white birch, and to a lesser extent wire birch, was generally severe between Boiestown and Upper Blackville, from Boiestown north to Rocky Brook, and at Stanley, Florenceville, Juniper, and Grand Falls. Moderate attacks were scattered throughout Northumberland County and between Caraquet and Bathurst in Gloucester County. Elsewhere in New Brunswick damage was light and, as in 1958, lowest in the southern part of the Province.

The insect was common in many parts of Nova Scotia on white birch and to a lesser extent on apple and alder. The only severe browning was on

Cape Breton Island, particularly near Ingonish, where browning averaged 70 per cent and some white birch trees lost about 90 per cent of their leaves. At Riverside, Inverness County, about 90 per cent of the foliage on white birch reproduction was destroyed but larger trees were only lightly attacked. Light browning was observed in Cumberland County between Wards Brook and Apple River, and from Shulie River to Joggins.

Light browning of wire birch foliage was observed on Prince Edward Island at Cavendish and near Orwell.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 15 | 28 |
| Nova Scotia..... | 5 | 44 |
| Prince Edward Island..... | 1 | — |

Birch Leaf Miner, *Fenusa pusilla* (Lep.) and **Birch Leaf-mining Sawfly**, *Heterarthrus nemoratus* (Fall.)—Birch leaf miner injury to white birch and wire birch in New Brunswick was generally severe throughout York County, severe but patchy on small trees and on reproduction in the Upper St. John River Valley, light to moderate in Northumberland, Gloucester, and Restigouche counties, and light in the southern parts of the Province, particularly near the coast.

Some browning of white and wire birch leaves was evident throughout Nova Scotia. The most severe attacks, where from 30 to 50 per cent of the foliage was destroyed, occurred near Thorburn, Westville, Stellarton, Trenton, and McPherson Mills, Pictou County; at Tatamagouche and between Brookfield and Upper Stewiacke, Colchester County; and at Wallace Ridge and Pugwash River, Cumberland County. The birch leaf miner caused most of the damage in Nova Scotia but sometimes the birch leaf-mining sawfly contributed. Of 20 collections from Cumberland, Colchester, and Hants counties, 13 contained birch leaf miner only and 7 contained both species, birch leaf-mining sawfly predominated in 5.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 15 | 23 |
| Nova Scotia..... | 9 | 78 |

Satin Moth, *Stilpnotia salicis* (L.)—Infestations were more numerous and intense in northeastern New Brunswick than in 1958. Severe defoliation occurred on balsam poplars at Riviere des Caches and at Six Roads, Northumberland County, on Carolina and silver poplars at Shippegan, and on Lombardy poplars and Carolina poplars at Beresford and near Petit Rocher, Gloucester County. Light to moderate defoliation, ranging from a trace to 50 per cent, was observed in a number of other areas. The only other infestations observed in New Brunswick were at Salisbury and at Moncton, where from 30 to 80 per cent of the foliage of Carolina and silver poplars trees was destroyed, and at Holmesville, Carleton County, where one silver poplar tree was completely defoliated.

In Nova Scotia, satin moth larvae caused moderate defoliation on a few silver poplar trees at Cheticamp, Inverness County, and light defoliation of silver poplars and willows at Linden, Cumberland County.

Numbers were low in Prince Edward Island. Traces of defoliation on Carolina and silver poplars were observed at New Glasgow, Bedford, and Rustico, Queens County; at O'Leary, Prince County; and at St. Peters, Kings County.

A polyhedral virus disease was found in larvae collected at Cheticamp, N.S.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 24 | 32 |
| Nova Scotia..... | 3 | 12 |
| Prince Edward Island..... | 2 | 2 |

Beech Scale, *Cryptococcus fagi* (Baer.)—The beech scale was found in small numbers in two new areas within its known limits of distribution in New Brunswick: on the Plaster Rock–Renous Highway as far west as Mile 34, and as far west as Mile 20 on the Fraser–Burchill Road.

Tallies of plot trees and general observations showed that most beech trees are lightly infested and, in the areas of older infestation most such trees are cankered as a result of previous attack by the scale and infection by the fungus, *Nectria coccinata* var. *faginata* Lohm., Wats. and Ayers. Moderate to severe stem infestations were found in New Brunswick at Boishebert, Gloucester County, on the Health Steel Mines road, and at Miles 15 and 17 on the Fraser–Burchill road, Northumberland County, and at Fredericton. Attacks of corresponding intensity were observed in Nova Scotia at East Folly Mountain, Colchester County, and at Annis Lake, Queens County.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 15 | 16 |
| Nova Scotia..... | 5 | — |

Winter Moth, *Operophtera brumata* (L.)—The status of winter moth infestations in 1959 and its known distribution are outlined on the accompanying map. The insect was collected for the first time at Wharton, Cumberland County; at Hebron and Ohio, Yarmouth County; and as far east as Lower South River, Antigonish County, and on Route 7 between Sheet Harbour and Antigonish. This introduced pest, which feeds on a number of hosts, particularly red oak, white elm, and apple, has now been found in every county on the mainland of Nova Scotia.

Defoliation was generally moderate in areas of older outbreak in western Nova Scotia. Defoliation remained severe, however, at Timberlea, French Village, Hubbards, Chester, Mahone Bay, near Bridgewater, New Germany, and from Pleasant River to Caledonia, and south to Liverpool and Mill Village. Severe infestations also occurred along Route 1 from Grand Pré to St. Croix and Newport Corner, but were more spotty than in 1958.

Only the winter moth was found in several localities where both the fall cankerworm and winter moth were found in previous years. The few places where both species were observed in 1959 are listed in the 'Fall Cankerworm' section below.

Nematodes of the collective genus *Agamomermis* were reared from winter moth larvae collected at Chester Grant, Lunenburg County. Small numbers of the native parasites *Apanteles* sp. and *Agathis* sp. near *gibbosa* were reared from host larvae for the first time in 1959. The introduced species *Agrypon flaveolatum* (Grav.) and *Cyzenis albicans* (Fall.) have been recovered by D. G. Embree from winter moth larvae collected at Oak Hill, Lunenburg County, in 1958; both parasites were last liberated at Oak Hill in 1956.

In 1959, about 1,500 specimens of *A. flaveolatum*, *C. albicans*, and *Phorocera obscura* Fall. were liberated at three locations in Lunenburg County in co-operation with the Entomology Research Institute for Biological Control.

| | Reports | Collections |
|------------------|---------|-------------|
| Nova Scotia..... | 17 | 143 |

Fall Cankerworm, *Alsophila pometaria* (Harr.)—Population levels were low throughout the Maritimes.

Light defoliation of white elm trees was observed in New Brunswick at Woodstock, Hartland, Grand Falls, in the Newcastle–Chatham area, and near McGowan's Corner in Sunbury County. Small numbers were collected at Campbellton for the first time in several years but defoliation was negligible.

No defoliation was observed in Nova Scotia. Numbers were negligible on apple orchards near Berwick and Bridgetown, which were almost completely defoliated in 1958. Areas where the fall cankerworm and winter moth were found together and the proportions of the former to the latter were as follows: Stewiacke, Colchester County, 1:2; Rocky Lake, Halifax County, 1:2; Bedford, Halifax County, 1:7; Windsor Road, Lunenburg County, 1:8; New Germany, Lunenburg County, 1:13; and Mill Village, Queens County, 1:99.

No fall cankerworms were found in Prince Edward Island.

A braconid parasite, *Rogas* sp., was reared from the cankerworm for the first time in 1959.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 8 | 18 |
| Nova Scotia..... | 4 | 45 |

Ugly-nest Caterpillar, *Archips cerasivoranus* (Fitch)—The unsightly webs of this insect were common on roadside cherry bushes in New Brunswick. Webs and defoliation were particularly noticeable in parts of central York County and Sunbury County; throughout the Upper St. John River Valley; on Route 8 between Doaktown and Newcastle, near Chatham, Bartibog, and Tabusintac, Northumberland County; between Bathurst and Pointe Verte, Gloucester County; and near Dalhousie and Glenlivet, Restigouche County.

Webs were found on chokecherry throughout Nova Scotia. Counts of webs within three 1,000-square-foot areas in eastern Nova Scotia indicated that numbers were considerably lower than in 1958.

| No. nests | Greenfield | Havre Boucher | Creignish |
|-----------|------------|---------------|-----------|
| 1958..... | 202 | 38 | 90 |
| 1959..... | 9 | 2 | 23 |

A bacterial disease was common in host larvae collected in Nova Scotia. This, and the high incidence of insect parasites, including *Dichaetoneura leucoptera* Jn. and *Eusisyropa* (*Zenillia*) *blanda* (O.S.), and others, will probably result in even lower host populations in 1960.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 13 | 57 |
| Nova Scotia..... | 4 | 46 |
| Prince Edward Island..... | 1 | 2 |

Fall Webworm, *Hyphantria cunea* (Drury)—The fall webworm was observed on 17 species of deciduous trees and shrubs. Nest tallies along roadsides in New Brunswick indicated a decline to an average of about one nest in 2 miles. In Nova Scotia, population levels were lower than in 1958 except in Digby County and in the Annapolis Valley, where numbers increased slightly to an average of about 44 nests per mile. In eastern Nova Scotia counts were highest between Brule, Colchester County and River John, Pictou County, where the number of nests per mile averaged about 41. The nests tallied between Afton and Monastery, Antigonish County, in 1958 and in 1959 averaged about 37 and 22 per mile. About six nests per mile were recorded between Creignish and Long Point, Inverness County.

The incidence of parasitism in 1959 rearings was high and webworm numbers are expected to be further reduced in 1960.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 3 | 30 |
| Nova Scotia..... | 4 | 160 |
| Prince Edward Island..... | 1 | 5 |

White-marked Tussock Moth, *Hemerocampa leucostigma* (J. E. Smith)
—Population levels remained low.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 1 | 2 |
| Nova Scotia..... | 2 | 3 |

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.)—This sawfly caused moderate to severe defoliation on a few ornamental American and European mountain ash trees at several locations in New Brunswick and in Nova Scotia, including Fredericton, Newcastle, and Truro. However, defoliation generally was light.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 5 | 21 |
| Nova Scotia..... | 3 | 22 |
| Prince Edward Island..... | — | 1 |

A Leaf Roller on Maple, *Sparganothis pettitana* (Rob.)—The first collection in the Maritime Provinces were made in 1956, when small numbers were found on red maple trees along Portobello Creek, in the Burpee Game Refuge, and at Fredericton in New Brunswick. In 1957 and in 1958, larvae were collected in York and Sunbury counties and numerous adults were collected in a light trap at Fredericton. In 1959 fewer larvae and adults were collected in the Fredericton area, but severe defoliation of red maple trees occurred on the Boiestown-Bantalar and Boiestown-Bettsburg roads. Light infestations were observed in Northumberland County at Moran Settlement, and on the Cains Portage at Muzroll Brook. Infestations were not observed in other parts of the Maritimes.

Larvae were occasionally collected from sugar maple and silver maple but not from basswood, the usual host (MacKay, Margaret R., Can. Ent. 85:233-242. 1952).

At least two species of parasites have been reared; one of these was identified as *Apanteles* sp. by W. R. M. Mason.

| | Reports | Collections |
|---------------------------|---------|-------------|
| New Brunswick..... | 2 | 23 |
| Prince Edward Island..... | — | 1 |

Striped Alder Sawfly, *Hemichroa crocea* (Fourc.)—An infestation of this sawfly destroyed about 80 per cent of the foliage on alders between Sutherland River and Pinetree, Pictou County, Nova Scotia. The outbreak reported in 1958 at Southwest Mabou has subsided.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 2 | — |
| Nova Scotia..... | 2 | 3 |

Alder Flea Beetle, *Altica ambiens alni* (Harris)—Patchy but severe loss of alder foliage by this beetle was observed in Nova Scotia along Route 11 between North River and Tatamagouche, and east along Route 6 to Pictou and Alma, in the Ben Eoin and Big Pond areas of Cape Breton County, near Bridgetown, and at Newport Corner, Hants County.

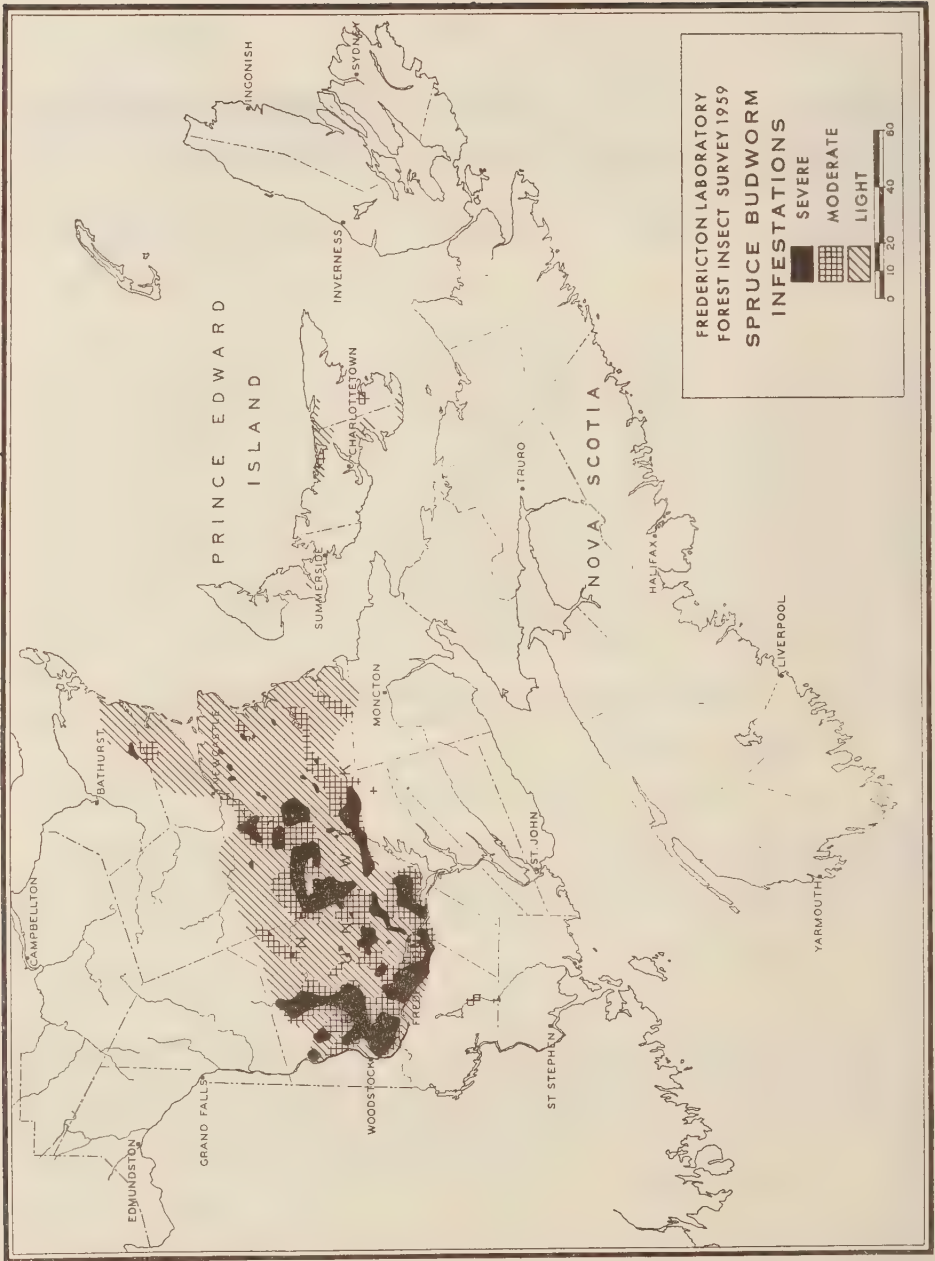
| | Reports | Collections |
|------------------|---------|-------------|
| Nova Scotia..... | 4 | 7 |

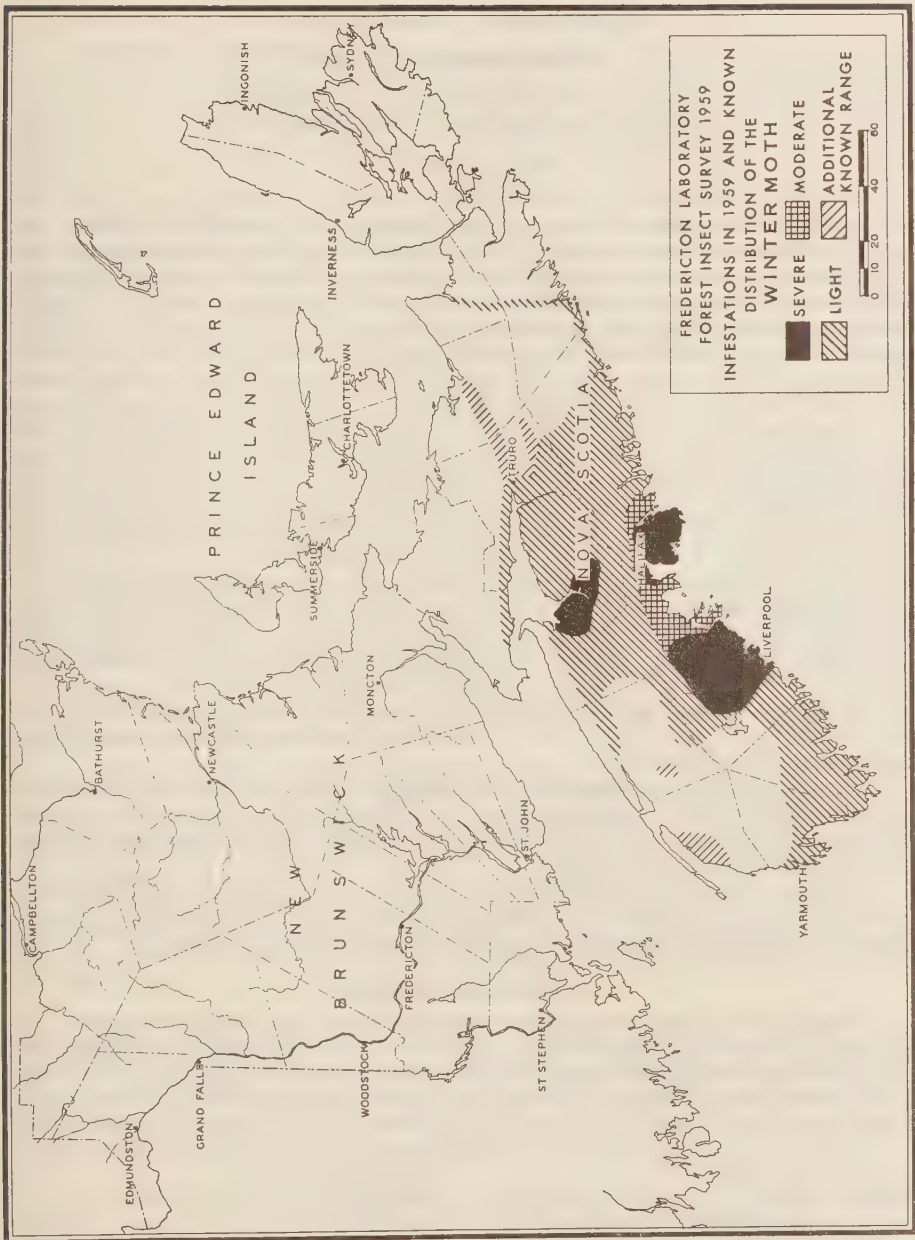
Lilac Leaf Miner, *Gracillaria syringella* (F.)—Light browning of foliage on lilac hedges and shrubs was observed in New Brunswick at Boiestown, Doaktown, Blackville, Millerton, Newcastle, Chatham, Dalhousie, and Campbellton.

| | Reports | Collections |
|--------------------|---------|-------------|
| New Brunswick..... | 1 | 3 |

OTHER NOTEWORTHY INSECTS

| Insect | Host | Locality | Remarks |
|---|-------------------------------|--|---|
| <i>Matsucoccus</i> sp. (Homoptera: Margarodidae) | Pine, white | Several localities in N.B. and N.S. | Found on bark, generally associated with fungus mats of <i>Septobasidium pinicola</i> Snell. First record in Maritimes. |
| <i>Profenusa thomsoni</i> (Konow) (Hymenoptera: Tenthredinidae) | Birch, white, yellow, wire | Scattered locations in N.B. and N.S. | First found in small numbers in N.B. in 1957, and in N.S. in 1959. |
| <i>Xyllococcus</i> sp. prob. <i>betulae</i> Per. (Homoptera: Margarodidae) | Beech; birch, yellow | Scattered locations in northern and cen- tral N.B. | Deeply embedded in bark crevices, within exudations of wax. Small numbers found. New record in Maritimes. |





MARITIME PROVINCES

FOREST DISEASE SURVEY

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INTRODUCTION

Weather conditions in 1959 in the Maritime Provinces were generally favourable for the development of tree diseases and both non-parasitic and parasitic diseases were common. Although early winter temperatures were about average, snow cover was late in developing and the soil was deeply frozen. These conditions were responsible for an unusual amount of winter killing of deciduous trees and shrubs, especially ornamentals. Winds were exceptionally common during March and these probably contributed, as did also the deeply frozen soil, to the winter drying of conifers that was prevalent in the Region. May was relatively warm and dry with record or near-record high temperatures occurring near the end of the month. This unseasonably warm weather delayed or prevented the development of some parasitic foliage diseases and was responsible for some leaf scorch of broad-leaved trees. June on the other hand, was very cool and wet, which provided conditions suitable for the development of certain foliage diseases. Late frosts were recorded at several stations in New Brunswick and at many in Nova Scotia. A particularly vicious storm with very strong winds struck the Maritime Provinces in June and noticeable wind damage to broad-leaved trees, particularly poplar, was reported in southern New Brunswick and Prince Edward Island. July was generally warm and dry with additional leaf scorch developing. August was an unusually dull and rather cool month and early frost was reported from low-lying areas in Nova Scotia.

A survey, again conducted jointly by the Forest Biology and Plant Protection divisions, showed that the Dutch elm disease was present in additional localities in New Brunswick.

A total of 333 collections was handled during the year. Samples collected to determine the fungi causing decay and damping-off of various tree species are not included in the total. In addition, numerous reports of disease conditions were made by the Survey staff.

Members of the Plant Research Institute, Ottawa, assisted with the identification of fungi. Dr. René Pomerleau, Forest Biology Laboratory, Quebec, confirmed some of the identifications of the Dutch elm disease fungus.

IMPORTANT DISEASES

Dutch Elm Disease—During 1959, the Dutch elm disease survey in the Maritime Provinces was restricted to areas in which the disease was not known to occur previously. The causal fungus, *Ceratocystis ulmi* (Buism.) C. Moreau, was isolated from 20 of the 54 suspect elm trees sampled. Diseased trees were found for the first time in 15 additional localities in New Brunswick as follows:

Carleton County

Avondale
Bath
Centreville
Hartland
Lower Brighton
Lower Northampton
Stickney
Upper Brighton
Wakefield

Victoria County

Bon Accord Road
Kilburn
Perth

York County

Durham Bridge
Pinder
Upper Lincoln

This brings the number of localities in which diseased trees have been found to 29 (see map). Of these, 18 are in Carleton County, 6 in Victoria County, and 5 in York County.

Winter Drying of Conifers—Scattered, but occasionally heavy, damage from winter drying was reported on most coniferous species throughout the region. The most conspicuous damage was reported to species of pine, especially red pine. Damage to this species was widespread in western Nova Scotia, particularly in the Annapolis Valley, and in Prince Edward Island. Considerable damage to Scots pine occurred in a plantation at Cross Creek, York County, N.B.

Frost Damage—Late frost damage to the new shoots of balsam fir and white spruce occurred throughout Nova Scotia but was most common in Cumberland and Colchester counties. In New Brunswick, very light damage to the shoots of balsam fir was observed during spruce budworm surveys at localities in Kent, Queens, Restigouche, and Victoria counties. In Prince Edward Island, very light damage to balsam fir was observed in Prince County.

Leaf Scorch—Leaf scorch was evident on shade and roadside trees, especially sugar maples, in most localities of the region.

A browning of the foliage of red maple, sugar maple, and beech was common in forest stands in Cape Breton Island, N.S., particularly around the Bras d'Or Lakes, and in Kings and Queens counties, P.E.I. This condition resembled leaf scorch but damage from other non-parasitic or parasitic diseases occurred in the same areas and these may have played a part.

Anthracnoses of Broad-leaved Trees—The causal fungus of anthracnose of maple, *Gloeosporium apocryptum* Ell. & Ev., was responsible for considerable browning of leaves and some premature defoliation of sugar maple at localities in Madawaska, Victoria, Northumberland, Albert, and Charlotte counties, N.B. and around the Bras d'Or Lakes, Cape Breton Island, N.S. In the Rocky Brook area, York County, N.B., the fungus attacked the leaf petioles predominantly and caused very heavy defoliation.

Damage to the foliage of beech from *Gloeosporium fagicola* Pass. was very common at localities in Prince Edward Island and Cape Breton Island.

Anthracnose of ash, *Gloeosporium aridum* Ell. & Holw., was common throughout the Annapolis Valley, and in Yarmouth and Digby counties, N.S. A few collections of the disease were made in Cumberland and Inverness counties, N.S.

Noticeable browning of the leaves of red oak, caused by *Gloeosporium quercinum* West., was observed in York, Kings, and Queens counties, N.B. Infections for the most part were confined to reproduction and lower leaves of larger trees.

Willow Blight—Damage from willow blight, caused by *Fusicladium saliciperdu* (All. & Tub.) Lind. and *Physalospora miyabeana* Fuk., was generally light in New Brunswick and Prince Edward Island. In New Brunswick damage was moderately heavy along the Magaguadavic River, Charlotte County. In Nova Scotia, damage was generally more severe, particularly in the Annapolis Valley, central Colchester County, and Antigonish County.

Ink Spot of Aspen—Although ink spot of aspen, *Ciborinia whetzellii* (Seav.) Seav., was observed throughout the Region, infections as a rule were light. The heaviest infection was reported on Route 8 between Allardville and Bathurst, Gloucester County, N.B., where 50 per cent of the leaves were affected on occasional trees.

Ash Rust—This disease, caused by *Puccinia sparganioides* Ell. & Barth., was again common in coastal areas of Nova Scotia, but damage was light.

Leaf and Twig Blight of Poplar—Leaf and twig blight, *Pollacia radiosa* (Lib.) Bald. & Cif. was observed throughout the Maritime Provinces on trembling aspen, but did not appear to be as common as in 1958.

Cherry Blight—Cherry blight, presumably a bacterial disease, was noted in most districts but was light and scattered. The disease appeared to be more severe in Prince Edward Island than in New Brunswick but the heaviest damage was observed at localities in Antigonish and central Guysborough counties, N.S. At these locations, 10 per cent of the new shoots were killed on approximately 25 per cent of the trees.

Needle Cast of Spruce—The needle cast of the 1957 needles of red spruce referred to in the 1958 Report was apparently caused by *Lophodermium filiforme* Darker. Fruiting bodies of this fungus were present on the affected needles in 1959.

Tip Blight of Balsam Fir—Tip blight, *Rehmiellopsis balsamea* Waterman, was noted on balsam fir in Richmond and Cape Breton counties, N.S. However, only the occasional twig was affected and damage was light.

Needle Rusts of Conifers—Rust, caused by *Chrysomyxa ledicola* Lagerh., was heavy or very heavy on the current foliage of spruce species at localities in Gloucester and Albert counties, N.B., and in Colchester, Halifax, and Yarmouth counties, N.S. *Chrysomyxa weirii* Jacks. was responsible for moderate damage to the one-year-old needles of red spruce near Kemptville, Yarmouth County, N.S.

Rust damage to the current foliage of balsam fir was generally light. Collections from Albert, Gloucester, and Restigouche counties, N. B., and Cumberland County, N. S., had 20 per cent or more of the needles infected.

Needle rust of tamarack, probably *Melampsora* sp., was common in Charlotte, Carleton, and Madawaska counties, N.B. At Glazier Lake, Madawaska County, young trees were heavily infected and appeared brown from a distance.

Eastern Gall Rust of Pine—Galls produced by *Cronartium quercuum* (Berk.) Miyabe ex Shirai were numerous on branches of jack pine reproduction near Burnt Church and Loggieville, Northumberland County, N.B.

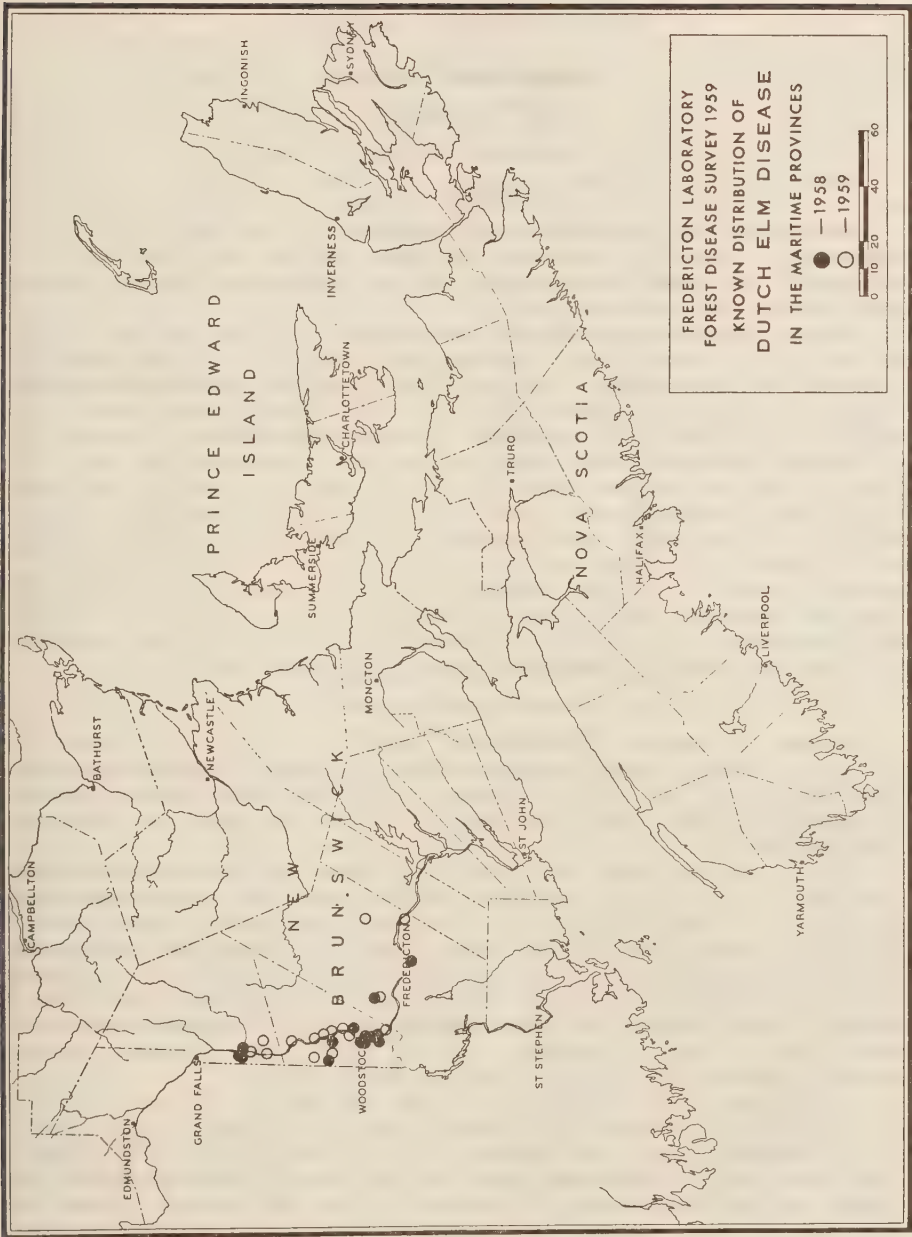
Nectria Canker of Birch—Cankers caused by *Nectria galligena* Bres. were common on the branches of yellow birch throughout southern New Brunswick and Prince Edward Island.

Leaf Blotch of Horsechestnut—Leaf blotch, *Guignardia aesculi* (Peck) Stew., was present on horsechestnut in most localities. Appreciable damage was observed only in Digby, Yarmouth, and Queens counties, N.S.

Dieback of Maple—A dieback of sugar maple, apparently of long standing, was common in the Rocky Brook area, York County, N.B.

OTHER NOTEWORTHY DISEASES

| Host | Organism | Locality | Remarks |
|-------------------|---|--------------------------|---|
| Ash..... | <i>Dendrophoma pruinosa</i> (Fr.) Sacc. | Glenlivet, N.B. | Associated with a dieback. First record for district. |
| Pine, white..... | <i>Atropellis tingens</i> Lohm. & Cash | Martins River, N.S. | Causes cankers. First record for district. |
| Spruce, white.... | <i>Rhizosphaeria kalkhoffi</i> Bub. | Ripples, N.B. | Reported as being a deadly parasite. First record for district. |
| Willow..... | <i>Nectria galligena</i> Bres. | Rossfield Crossing, N.B. | Causes cankers. New host record. |



PROVINCE OF QUEBEC

FOREST INSECT SURVEY

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INTRODUCTION

The general conduct of forest insect surveys in Quebec again followed the pattern adopted in 1955. Favourable early spring weather started insect activity much earlier than usual but a period of cold, dry weather soon brought seasonal insect development back to normal.

The spruce budworm continued to decline in 1959 and serious defoliation was recorded only in very restricted areas, particularly in the Lower St. Lawrence and Gaspé regions. The special aerial and ground surveys conducted for several years in connection with the aerial spray program, were discontinued. The Swaine jack-pine sawfly increased in abundance, particularly in parts of the St. Maurice watershed where special surveys were conducted this year. No appreciable change has been reported in other infestation areas. The larch sawfly is becoming abundant over a wider area each year; in 1959 outbreak conditions extended from the Abitibi district eastward through the central regions of Quebec. Numbers of the European spruce sawfly also increased in 1959 and it is now fairly common in several regions. Other forest insects mentioned in this report, are associated with projects of the Laboratory or are of particular interest to the Survey. The information received from various project leaders and the collections submitted by cooperators are gratefully acknowledged.

IMPORTANT INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)—Outbreaks of the spruce budworm, which have been declining since 1957, showed further decreases in 1959. Although this budworm is still prevalent, infestations have now reached the stage where larvae can only be found in significant numbers in a few restricted areas.

In the eastern regions, particularly the Lower St. Lawrence and Gaspé, where the Quebec Laboratory has been involved with aerial spray operations, the outbreak is now terminated. The very low population levels anticipated in 1959, on the basis of the 1958 egg survey, made further spraying unnecessary. Observations made in these regions during the period of larval activity indicated that the insect was relatively rare through most of the 13,000 square miles of territory. Light traps in the Matane watershed, an area seriously affected in previous years, caught no budworms for the second year. Extensive surveys usually conducted each fall were, therefore, discontinued.

Forest operators were requested to report any evidence of increased abundance. The Provincial Bureau of Entomology reported one such area of approximately 10 square miles at the headwaters of the Kedgwick and Mistigouèche rivers. Ground checks revealed patches of light to medium defoliation for the current and preceding year. Egg counts made at 20 locations included one high count while the rest were low or negative. Even though budworm numbers are relatively low, this area may possibly become the focal point of a renewed outbreak. Spraying is being contemplated, but no decision will be reached until larval counts can be made next spring.

With this one exception, the condition of the forest has improved considerably during the last two years. Trees which were not seriously affected are recovering and some of the dead timber has been salvaged.

Swaine Jack-pine Sawfly, *Neodiprion swainnei* Midd.—No important variation in the outbreaks of the Swaine sawfly was recorded except in the central sector of Quebec. The most important change was in the St. Maurice River watershed where substantial increases were evident, particularly in Livernois, Picard, and Dupuis townships, better known as the Chapeau de Paille-Lake Gagnon area. In the Chienne Depot area the outbreak decreased considerably in 1957 and no appreciable change has been recorded during the past two years. Sampling was done in 39 areas well distributed throughout the watershed, to determine the relative abundance of the insect on the basis of the average number of egg clusters per tree. Five trees located 200 feet apart along a line extending 1,000 feet from the road were cut at each sampling point and the clusters counted. The data summarized below indicate the relative abundance of eggs in the main area of infestation.

| Area | No. of localities | Percentage of trees affected | No. colonies per tree | |
|------------------------|-------------------|------------------------------|-----------------------|-------|
| | | | Average | Range |
| Chienne Depot..... | 3 | 53 | 0.7 | 0-3 |
| Chapeau de Paille..... | 4 | 40 | 1.7 | 0-12 |
| Lake Gagnon..... | 5 | 89 | 7.0 | 0-26 |
| Flamand Road..... | 2 | 80 | 1.4 | 0-4 |
| Oriskany Club..... | 5 | 72 | 1.8 | 0-5 |

Increased numbers were also recorded around Lake Brochet in the Shipshaw River watershed, Lake St. John district. At Lake Docteur, where the sawfly was abundant a few years ago, a decrease was observed.

Larch Sawfly, *Pristiphora erichsonii* (Htg.)—Significant changes occurred in 1959. In 1958, severe infestations were reported only in the Abitibi district but this year marked increases were apparent in southern and central Quebec and sawflies were fairly common throughout the western half of the Province. Defoliation was so evident that reports were received from many sources. Sequential sampling* was conducted in several localities of western and central Quebec in 1959. The estimates are based on the cumulative number of new shoots used for oviposition. The results are presented in the following synopsis:

| Locality | County | Infestation class 1959 |
|-----------------------|-------------|------------------------|
| Amos..... | Abitibi-Est | Severe |
| Senneterre..... | Abitibi-Est | Severe |
| Louvicourt..... | Abitibi-Est | Severe |
| LaVerendrye Park..... | Pontiac | Moderate |
| Grand Remous..... | Gatineau | Severe |
| Mont Laurier..... | Labelle | Moderate |
| Lacoste Station..... | Labelle | Light |
| Quebec..... | Quebec | Light |
| Laurentide Park..... | Montmorency | Light |

*Ives, W. G. H. and R. M. Prentice. 1958. A sequential sampling technique for surveys of the larch sawfly. Can. Ent. 90: 331-338.

In the localities sampled in Abitibi-Est County, trees appeared in very poor condition and produced very little foliage and new shoots, which may account for the reduced number of sound cocoons in the soil. Parasites were scarce; two species were recovered from the rearings, *Mesoleius tenthredinis* Morley and *Bessa harveyi* (Tns.), the former being the more numerous.

European Spruce Sawfly, *Diprion hercyniae* (Htg.)—According to reports, this insect was more common than usual in 1959. Intensive sampling in the Québec-Three Rivers-Mégantic area indicated a further small increase in abundance. Larvae were found on over 95 per cent of the 20-year-old spruce trees sampled. Annual comparisons are best made on the basis of the number of larvae in beating samples taken when the first generation larvae are in the third and fourth instars. The last three years' results are presented in the following table.

| Locality | Average larval population per tree | | |
|--------------------------|------------------------------------|------|------|
| | 1957 | 1958 | 1959 |
| Mégantic..... | 9.3 | 10.6 | — |
| Cap de la Madeleine..... | 10.7 | 13.9 | 16.1 |
| St-Féréol..... | 10.7 | 15.8 | 32.7 |
| St-Nicolas..... | 12.5 | 13.2 | — |
| St-Sylvestre..... | 13.8 | 11.4 | 15.6 |
| Ste-Agathe..... | 13.2 | 17.4 | 23.1 |

Sampling during the second generation always indicates a decrease attributable in large part to a virus disease. This year's decrease was greater than usual and mortality was higher both in the laboratory and in the field.

Parasitism was again extremely low and *Bessa harveyi* (Tns.) was recorded for the first time.

European Pine Shoot Moth, *Rhyacionia buoliana* (Schiff.)—Observations were continued in 1959 on mugho pines in the Quebec City area. The condition of infested trees has improved considerably since 1957 when insect numbers were greatly reduced by unfavourable winter conditions. Deep snow last winter protected the larvae but parasitism increased sufficiently to keep the population level low. A collection received from a nursery at Sayabec, Matapeia County, represents the most northern record for the Province.

Red-headed Jack-pine Sawfly, *Neodiprion virginianus* complex—Numbers of this insect increased noticeably in the main area of infestation previously reported in Settrington Township, Charlevoix County. The insect was also more common in jack pine stands in surrounding areas but only light defoliation was recorded. Parasitism was generally high again this year and several species of parasites were recovered from the rearings.

Larch Casebearer, *Coleophora laricella* (Hbn.)—For a number of years special sampling* has been conducted for this insect. The plains of the St. Lawrence River and the Eastern Townships appear to be the only regions

*Webb, F. E. 1957. Sampling techniques for the overwintering stage of the larch casebearer.—Bi-Mon. Prog. Report Vol. 13 (4).

where the casebearer is important. The infestation was classed as light throughout these areas in 1959. Several species of parasites were recovered including two imported species, *Agathis pumila* (Ratz.) and *Chrysocharis laricinellae* (Ratz.), which are important control factors.

Eastern Hemlock Looper, *Lambdina fiscellaria fiscellaria* (Guen.)—No appreciable changes have been reported in the abundance of this destructive insect in the two areas where outbreaks have occurred during the past decade. According to information received from the Vachon and May Islands watersheds, the 1956 outbreak area, there was no evidence of defoliation in 1959. Sampling in Gaspé-Nord County, where an infestation occurred around 1950, showed that the population level was very low.

Maple Leaf Cutter, *Paraclemensia acerifoliella* (Fitch)—In 1959, several samples were received from Brome and Stanstead counties in the Eastern Townships where some defoliation has been recorded since 1957. Some sugar maple stands have been severely defoliated for the last three years.

Poplar Sawfly, *Trichiocampus viminalis* (Fall.)—In 1959, the numbers of this sawfly were again very low on poplars in the Quebec City area. A virus disease has been responsible for the destruction of most of the larvae in recent years. Diseased larvae were collected again in 1959.

Poplar Leaf Miner, *Phytomyza populicola* (Hal.)—In recent years, special studies have been conducted within a 30-mile radius of Quebec City and the number of localities where this introduced insect is present increased considerably in 1959. Occasional collections of the insect were also made outside the main area of investigation, namely, at St. Pascal, Kamouraska County; Baie St. Paul, Charlevoix County; and Three-Rivers. Laboratory rearings showed that parasitism was important in most localities and that it was particularly high at Three-Rivers.

A European Alder Sawfly, *Eriocampa ovata* (Linn.)—A slight decrease in the population level of this insect on *Alnus incana* (L.) was noted in 1959 at St. Augustin, Portneuf County. Defoliation in this small infestation was approximately 30 per cent. No parasites were recovered from the rearings.

Satin Moth, *Stilpnotia salicis* (L.)—In 1959 larvae were occasionally found on poplars in Quebec and Ste. Foy. Satin moths were also reported as quite abundant on poplars in northeastern Montreal.

Nursery Pine Sawfly, *Gilpinia frutetorum* (F.)—This species was found in a Scots pine plantation near Shawinigan, St. Maurice County, in the fall of 1959. Although the insect was quite common, no defoliation was apparent. This is the first Survey record of this insect occurring in Quebec.

Willow Shoot Sawfly, *Janus abbreviatus* (Say)—Shoots bored by this sawfly were very common on eastern cottonwood near Berthierville. However, the insect was not found in the numerous localities where this tree species was sampled in 1959.

White grubs, *Phyllophaga* spp.—Serious damage to white pine transplants was reported from near the Normandin nursery in Roberval County. Roots of the specimens submitted showed typical white grub injury. This is a common problem in newly established nurseries.

OTHER NOTEWORTHY INSECTS

| Insect | Hosts | Locality | Remarks |
|--|----------------------|--|--|
| <i>Altica carinata</i> Germ. | Elm | Sutton, Brome-Missisquoi Co. | Few trees severely infested. |
| <i>Alsophila pomelaria</i> (Harr.) | Maple, red and sugar | St. Vallier, Bellechasse Co. | Marked decrease in abundance from previous years of this and associated loopers. |
| <i>Anchylopera burgessiana</i> Zell. | Oak, red | Ste. Foy, Quebec-Montmorency Co. | First Survey record. |
| <i>Erannis tiliaria</i> (Harr.) | Oak, red | Ste. Foy and Cap Rouge, Quebec-Montmorency Co. | Common on this and other deciduous trees. |
| <i>Neodiprion pratti banksianae</i> Roh. | Pine, jack | Chateau d'Eau, Quebec-Montmorency Co. | New locality record at southern limit of jack pine range. |
| <i>Operophtera bruceata</i> (Hlst.) | Oak, red | Ste. Foy, Quebec-Montmorency Co. | Rare; associated with loopers in mixed hardwood woodlots. |
| <i>Phenacaspis pinifoliae</i> (Fitch) | Spruce, blue | Quebec | Fairly common on ornamental spruce plantings. |
| <i>Sparganothis sulfureana</i> Clem. | Pine, Scots and red | Low, Gatineau Co. | Moderate infestation in a plantation of 100,000 pines. |

PROVINCE OF QUEBEC

FOREST DISEASE SURVEY

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INTRODUCTION

In Quebec the 1959 growing season was, except for a drought period in July, favourable to tree growth. Foliage disease were less abundant than in 1958, but needle rusts were common on spruce. Late frost caused leaf injuries in some areas, particularly on maples and poplars. Winter drying mildly affected conifers, particularly along roadsides. As in previous years, the number of collections was quite limited, sampling being only done by members of the laboratory staff.

Bark Cracking of Balsam Fir—A peculiar circumferential bark cracking on the underside of branches, and a severe reddening of needles were observed on balsam fir trees at five locations northeast of Quebec City in 1959. At Chauveau, Charlevoix County, this condition was common over an area of 54 square miles on 10- to 50-year old trees. Affected branches had a southwestern exposure and were at varying distance from the ground. Smaller areas of 10- to 15-year old saplings in open or partially open stands at St. Hilarion, Charlevoix County, at Tadoussac, Saguenay County, and at two locations along the Ste. Anne River, Montmorency County, were affected. Along the Ste. Anne River, most diseased branches were near the top of trees and had a southeastern exposure.

Snow Blight—The snow blight fungus, *Phacidium infestans* Karst., was prevalent on susceptible conifers in several areas in the spring. Infections on spruce seedlings were reported in nurseries at Normandin, Roberval County, and at Valcartier, Quebec County. At Valcartier 10 per cent of 2-2 red spruce seedlings were killed.

Winter Drought on Red Pine—Browning of one-year-old red pine foliage attributable to adverse weather conditions in late winter or early spring was extensive in Sorel and vicinity.

Sunscauld on White Pine—In an eight-year-old plantation near the Normandin Nursery, Roberval County, most of 15,000 planted white pines were affected by reddish lesions, girdling the stems at about the same height. No organisms were consistently isolated from the cankered areas. This condition, suggestive of sunscauld in the spring near the snow level, appears to have followed serious attacks by white grubs (see Forest Insect Survey section). Numerous trees were dead by July, and there was little chance of recovery for the majority of the remaining affected trees.

Needle Cast on Balsam Fir—General infection by needle cast fungi was observed on one-year-old needles of six- to eight-year-old fir reproduction in partially opened stands at l'Epaule, Laurentide Park. Mature trees nearby were also infected. In July, pycnidia were present on the affected needles. *Hypodermella mirabilis* Darker, *Hypodermella nervata* Darker, and *Bifusella faullii* Darker, were the organisms concerned.

Needle Rusts—*Chrysomyxa ledi* de Bary and *C. ledicola* Lagerh. were common on black and white spruce at a few locations. Rusts caused by undetermined species of *Chrysomyxa* were also reported to be prevalent on black spruce in the Upper St. Maurice region, St. Maurice County, and on white spruce at Tadoussac, Saguenay County.

In addition, a microcyclic rust species with telia fruiting on one-year-old needles was found on black spruce in the Laurentide Park. The fungus was tentatively identified as *Chrysomyxa weirii* Jacks. This appears to be the first record of this rust in Quebec, and the first record of its occurrence on black spruce.

Needle Distortion of White Spruce—A general yellowing, curling, and thickening of the current year's needles with resulting stunted terminal growth, affected a number of white spruce trees in a plantation at Grand'Mère, St. Maurice County. The cause of this abnormal growth was not determined.

Dutch Elm Disease—The number of elm samples submitted for diagnosis was much reduced this year, since only doubtful samples are now received from cities where Dutch elm disease is well established. A total of 195 samples were diagnosed during 1959.

The disease was found for the first time at the following places: Chateau Richer, Montmorency County; Ste. Anne du Lac and Mont Laurier region, Labelle County; and St. Charles, Bellechasse County.

Canker Diseases of Hardwoods—*Nectria* cankers have been given special attention as part of a study on cankers affecting hardwoods. At Duchesnay and Portneuf (near Quebec City), *Nectria galligena* Bres. affecting yellow birch was frequent in some spots. Large trees have been killed by the girdling from the growth of the fungus.

Poplar Diseases—The poplar hybrid resistance studies of the Quebec Laboratory provided the following data in 1959.

Foliage diseases on native poplars were less severe in 1959; early spring infections by many common organisms being greatly reduced by a dry May. However, at Berthierville, Berthier County, high levels of infection by *Marssonina populi* (Lib.) Sacc. and *Septoria musiva* Pk. were observed in early June on *Populus deltoides* Marsh. growing on low moist sites. In late summer and early fall, moderate development of *Pleuroceras populi* Thompson and *Melampsora medusae* Thüm. occurred on aspen at several locations. The latter fungus appeared much later than last year. Throughout the summer, only moderate outbreaks of *Pollacia radiosia* (Lib.) Bald. & Cif. were observed, except where heavy infections were recorded in 1958.

Cankers from which a *Fusarium* sp. was consistently isolated were found affecting *P. deltoides* in stands near Berthierville. *Neofabraea populi* Thompson and *Dothichiza populea* Sacc. & Br. were also found on *P. deltoides* in association with dieback symptoms. *N. populi* was isolated from cankers on aspen at St. Alexandre, Kamouraska County, and at St. Paulin, Maskinongé County, and also on hybrid poplars of unknown origin at Duchesnay, Portneuf County. This disease appears to be confined to poplars growing on extremely dry sites. *Nectria* cankers were prevalent on aspen near St. Alexandre, St. Paulin, and St. Etienne, Lévis County. This disease is widespread on *P. grandidentata* Michx.

In 1959, two foliage diseases were recorded for the first time in Quebec on introduced poplars. At Macdonald College, a foliage disease with which *Plagiostoma populi* Cash & Waterm. has been associated was observed on clones of *P. tremula* and of *P. alba* × *P. grandidentata*. At Quebec City, a leaf spot on selections of the cross *P. tremuloides* × *P. tremula* reached serious proportions, attacking 90 per cent of the trees. The causal agent has not yet been determined.

Several dieback and canker diseases were also found on introduced poplars. At Calumet, Argenteuil County, a stand of eight-year-old trees of the crosses *P. candicans* × *P. berolinensis* and *P. berolinensis* × *P. simonii* were severely affected by a canker that probably resulted from alternate periods of freezing and thawing during late winter. A *P. berolinensis* × *P. simonii* hybrid was also infected with *Septoria* canker which produced cankers on the main stem and lateral branches of the crown.

Dothichiza populea was observed for the first time on hybrid poplars in Quebec, although it was reported in 1958 on Lombardy and Carolina poplars in Quebec City. *P. deltoides* × *P. petrowoskyana* hybrids, severely damaged by drought injury and competition from grasses, had *D. populea* associated with dieback symptoms at Harrington Forest Farms, Calumet, Quebec.

Several new host records of diseases were also recorded on introduced poplars. These include *Linospora tetraspora* Thompson on *P. euramericana*, on *P. angulata* × *P. simonii*, and on *P. nigra* × *P. laurifolia*; *Septotinia populi-perda* Waterm. & Cash on *P. candicans* × *P. berolinensis*; *Cladosporium* sp. on *P. euramericana* and *P. deltoides* × *P. balsamifera*; and *Marssonina populi* (Lib.) Sacc. on *P. pacheri* and *P. petrowoskyana*. *Mycosphaerella populicola* Thompson was also found on cuttings of *P. trichocarpa* obtained from British Columbia and planted out this spring. This was the only host recorded for this organism in the poplar plantations, although the closely related pathogen *Mycosphaerella populorum* Thompson was widespread.

OTHER NOTEWORTHY DISEASES

| Host | Organism | Locality | Remarks |
|---------------------------------------|--|-----------------------|---|
| <i>Abies balsamea</i> Mill..... | <i>Corticium fuscostratum</i> Burt | Laurentide Park | From cultures. |
| | <i>Hymenochaete agglutinans</i> Ell. | Duchesnay, Que. | Growing from a fir branch and fruiting on maple. |
| <i>A. concolor</i> Lindl..... | <i>Rehmiellopsis balsameae</i> Waterman | St. Roch des Aulnaies | Present on some trees in nursery. First record in the Province. |
| <i>Betula papyrifera</i> Marsh..... | <i>Taphrina carnea</i> Johanson | Ste. Foy, Que. | Low incidence. |
| <i>Populus tremuloides</i> Michx..... | <i>Taphrina johannsonii</i> Sad. | Loretteville, Que | Common. |
| <i>Prunus pensylvanica</i> L..... | <i>Taphrina cerasi</i> (Fckl.) Sad. | Quebec City | Caused witches' brooms on a few trees. |
| <i>Salix bebbiana</i> Sarg..... | <i>Rhytisma salicinum</i> (Pers.) Fr. ex Fr. | Amos, Abitibi | Low incidence. |
| <i>Ulmus pumila</i> L..... | <i>Tubercularia ulmea</i> Carter | Montreal | Many hedges were severely infected. |
| <i>Viburnum cassinoides</i> L..... | <i>Plasmopara viburni</i> Peck | Duchesnay, Que. | Common on this shrub over large areas. |

PROVINCE OF ONTARIO

FOREST INSECT SURVEY

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INTRODUCTION

The year 1959 saw little change in the species of forest insects known to be of major importance in Ontario forests. The spruce budworm continued to ravage balsam fir and spruce stands in northwestern Ontario, particularly between the Lakehead and Rainy Lake, and in the southern part of the Geraldton District. However, a general population decline in areas of light tree mortality and a slowing of the eastward advance of the outbreak in the Western Region were two encouraging developments. Defoliation by the larch sawfly became more severe, due mainly to a return to high population levels in larch stands in northwestern Ontario. In southern Ontario, infestations of the European pine shoot moth waned as a result of unusually high mortality of overwintering larvae. The European pine sawfly again proved troublesome to plantation owners and continued to spread into Bruce Peninsula and eastward into the Lake Simcoe District. Tree mortality continued in Scots pine plantations infested by the pine root collar weevil and several new infestations were found within the general limits of its occurrence in Lake Simcoe, Parry Sound, and Pembroke districts. A noteworthy extension in the known range of the smaller European elm bark beetle in southern Ontario was reported.

In recent years the emphasis placed on the occurrence, collection, and identification of some of the less conspicuous insects such as needle miners, shoot borers, leaf miners and tube makers, has lead to an increased knowledge of these insects. Sub-projects also include studies of the larch shoot moth, the elm bark beetles, *Eucosma* on pine, and the parasites of the European pine shoot moth and European pine sawfly.

In 1959, more than 135 requests for identifications and control measures were answered. Moreover, Forest Biology rangers distributed ten control pamphlets prepared in 1959 to help answer numerous extension calls.

The Forest Insect Survey received 7,617 collections containing 10,007 insect samples. The reduction of 1,700 collections compared with 1958 resulted from a policy of limiting the number of collections per district to 11 common forest pests, the infestations of which are reported annually. Forest Biology rangers submitted 6,974 collections independently and 299 jointly with personnel of the Ontario Department of Lands and Forests. The collections were distributed among the principal host trees as follows:

| Coniferous Trees | Collections | Broad-leaved Trees | Collections |
|----------------------------|-------------|---------------------------|-------------|
| Pine | | Poplar | |
| Jack pine..... | 1,268 | Trembling aspen..... | 721 |
| Red pine..... | 268 | Balsam poplar..... | 94 |
| White pine..... | 207 | Largetooth aspen..... | 19 |
| Scots pine..... | 196 | Miscellaneous poplars.... | 37 |
| Miscellaneous pines..... | 14 | | |
| | 1,953 | | 871 |
| Spruce | | Oak | |
| White spruce..... | 719 | Red oak..... | 114 |
| Black spruce..... | 289 | White oak..... | 46 |
| Miscellaneous spruces..... | 33 | Miscellaneous oaks..... | 44 |
| | 1,041 | | 204 |

| Coniferous Trees | Collections | Broad-leaved Trees | Collections |
|--|-------------|------------------------------------|-------------|
| Eastern white cedar..... | 194 | Birch | |
| Hemlock..... | 21 | White birch..... | 556 |
| Larch..... | 498 | Yellow birch..... | 26 |
| | | Miscellaneous birches..... | 7 |
| | | | 589 |
| Balsam fir..... | 376 | Elm..... | 233 |
| Juniper..... | 5 | Maple | |
| Total..... | 4,088 | Sugar maple..... | 100 |
| | | Red maple..... | 41 |
| | | Miscellaneous maples.... | 27 |
| | | | 168 |
| Miscellaneous hosts or hosts unspecified..... | 87 | Cherry..... | 462 |
| | | Willow..... | 327 |
| | | Alder..... | 212 |
| | | Mountain ash..... | 79 |
| | | Walnut, hickory..... | 40 |
| | | Ash..... | 68 |
| | | Basswood..... | 50 |
| | | Miscellaneous broad-leaved trees.. | 139 |
| | | Total..... | 3,442 |
| | | Grand Total..... | 7,617 |

Spruce Budworm, *Choristoneura fumiferana* (Clem.)—A remarkable decline in population levels occurred in the Western Region in 1959, with the result that the total area of heavy infestation was approximately one third of that reported in 1958. Meanwhile, in the Midwestern Region, the area of heavy infestation did not spread as far eastward as it had each year since 1954 and the intensity of infestations in the southern part of the Geraldton District abated slightly.

Populations declined to a low level in the western part of the Kenora and Fort Frances districts where heavy infestations prevailed in 1958. However, severe defoliation of host stands recurred from Rainy Lake eastward in the Fort Frances District and in a relatively small area near the eastern district boundary in the Kenora District. The extent of these and other infestations in Ontario is shown on the accompanying map.

The heavy infestation which persisted in the southern part of the Sioux Lookout District in recent years declined sharply in both extent and intensity. Residual budworm populations in this broad region caused light to moderate defoliation in a roughly triangular area with its apex at the eastern end of Lac Seul, bounded on the west by Highway 72 and on the east by Sturgeon, Sandbar, and Snowden lakes. The broad decline is demonstrated by the defoliation estimates shown in the following table.

| District | No. of sample locations | Estimated per cent defoliation | | Infestation forecasts for 1960 |
|---------------------------------|----------------------------------|-----------------------------------|------|---|
| | | 1958 | 1959 | |
| Sioux Lookout..... | 6 | 52 | 9 | N-M |
| Kenora..... | 10 | 51 | 9 | N-M |
| Fort Frances..... | 11 | 71 | 44 | L-H |
| Port Arthur (S.W. Section)..... | 3 | 89 | 70 | M-H |
| Geraldton..... | 7 | 57 | 52 | L-H |
| Lake Simcoe..... | 2 | 83 | 58 | L-M |

N — nil L — light M — medium H — heavy

In the southwestern section of the Port Arthur District, host stands were severely defoliated for the third consecutive year. The infestation showed little change in extent to the north but spread eastward in a long salient from Moss and Ames townships, through Haines and Hagey townships. The remainder of the eastern boundary of heavy infestation shifted eastward for an average distance of three miles. Farther east, in the area designated as light defoliation, a considerable increase in population level was observed on flower-bearing balsam fir trees between Iron Range and Whitefish lakes. Egg counts in late summer indicate that the outbreak will continue to decline in the Western Region in 1960, but will show little or no abatement in the southwestern section of the Port Arthur District, (see preceding table).

Older infestations on Sibley and Black Bay peninsulas and at Shillabeer Creek to the north, declined to very light intensity. One small heavy infestation in this general area occurred along the east shore of the Nipigon River. In the Geraldton District, the heavy infestation which has persisted north of Pays Plat since 1952 decreased in size. Population levels declined sharply in the south-central part of this infestation where severe tree mortality has occurred.

Although there was an appreciable decline in budworm numbers in white spruce plantations in the Uxbridge and Midhurst forests, Lake Simcoe District, defoliation estimates at both locations exceeded 50 per cent. Further declines are forecast for 1960.

Little change in balsam fir mortality occurred in the western part of the Sioux Lookout District and the central part of the Kenora District. To the east, light to moderate mortality was observed between Sioux Lookout and Sturgeon Lake and a similar condition occurred near Lake of the Woods, Kenora District. Mortality was light in the western part of the Fort Frances District. A high percentage of balsam fir in approximately one third of the Pays Plat infestation has been killed in the last three years.

| | | | |
|-------------------|----|-----------------------|----|
| Chapleau..... | 9 | Lake Simcoe..... | 3 |
| Cochrane..... | 1 | Lindsay..... | 1 |
| Fort Frances..... | 27 | Parry Sound..... | 2 |
| Geraldton..... | 33 | Port Arthur..... | 48 |
| Kapuskasing..... | 2 | Sault Ste. Marie..... | 10 |
| Kemptville..... | 1 | Sioux Lookout..... | 15 |
| Kenora..... | 16 | Sudbury..... | 8 |
| Lake Huron..... | 4 | White River..... | 7 |

Larch Sawfly, *Pristiphora erichsonii* (Htg.)—A steady eastward spread of the outbreak across northern Ontario and a gradual decline in its intensity in northwestern Ontario has been evident since 1954. This pattern was interrupted in 1959 by the re-appearance of moderate to severe defoliation over a large part of northwestern Ontario and static conditions to the east and south.

Medium to heavy infestations recurred at many points in the eastern part of the Western Region and throughout the Port Arthur District. Larch stands which had shown good recovery in recent years were again severely defoliated. Light to medium infestations persisted generally in the Geraldton District with pockets of heavy infestation occurring in widely separated areas. To the east in the Kapuskasing and Cochrane districts, population levels declined somewhat compared with 1958. Light to medium infestations were most commonly observed.

Larch stands in the Central Region and the Swastika District suffered from moderate to severe defoliation, except in the eastern part of the Sudbury District and the western part of the White River District where infestations were generally light. High population levels persisted between Highways 11 and 17 in the central part of the North Bay District. Although the insect increased in abundance in the Lake Simcoe and Lindsay districts, infestations were generally classed as light in southern Ontario.

Pentatomid predators had an appreciable effect on early-instar larval populations in many areas, particularly in parts of the North Bay and Pembroke districts and in the Southwestern Region.

| | | | |
|-------------------|----|-----------------------|----|
| Chapleau..... | 10 | Lindsay..... | 16 |
| Cochrane..... | 21 | North Bay..... | 13 |
| Fort Frances..... | 12 | Parry Sound..... | 24 |
| Geraldton..... | 17 | Pembroke..... | 23 |
| Gogama..... | 18 | Port Arthur..... | 27 |
| Kapuskasing..... | 18 | Sault Ste. Marie..... | 12 |
| Kemptville..... | 8 | Sioux Lookout..... | 19 |
| Kenora..... | 8 | Sudbury..... | 7 |
| Lake Erie..... | 3 | Swastika..... | 14 |
| Lake Huron..... | 19 | Tweed..... | 12 |
| Lake Simcoe..... | 14 | White River..... | 14 |

European Pine Sawfly, *Neodiprion sertifer* (Geoff.)—Infestations of this introduced insect showed a further substantial spread north and east of its known range in the Southwestern Region. It now occurs in plantations from Windsor and Sarnia, where it was first discovered in 1940, throughout most of the Lake Erie and Lake Huron districts and the western third of the Lake Simcoe District. In the latter district the insect is well established in Dufferin and Peel counties, in the western part of Simcoe County, and as far east as Highway 400 in York County.

Infestations in the Lake Simcoe District were generally light with pockets of medium intensity occurring only in the western part of Dufferin County. A concerted control program by property owners using virus and insecticide sprays has kept infestations to a low or medium level in numerous plantations in the older areas of infestation in the Lake Erie and Lake Huron districts. High population levels persisted, however, in the Courtland, Waterford-Delhi, and Newberry-Bothwell areas of the Lake Erie District and in some untreated plantations in the Lake Huron District.

The accompanying map shows the known range of the insect in southern Ontario in 1959 compared with 1958.

| | | | |
|-----------------|----|------------------|----|
| Lake Erie..... | 13 | Lake Simcoe..... | 20 |
| Lake Huron..... | 37 | | |

European Pine Shoot Moth, *Rhyacionia buoliana* (Schiff.)—Infestations have been much less severe in southern Ontario in 1958 and 1959 than in previous years. In 1959 the decline was caused largely by the low survival of larvae overwintering above the snow line. In some instances mortality exceeded 90 per cent. Local increases in infestation intensity in the Southwestern Region occurred in Albion Township, Lake Simcoe District, in a number of areas in the Lake Huron District, and in Scots pine plantations chiefly in Elgin and Norfolk counties, Lake Erie District. Increases were also observed in the southern part of the Lindsay District, with plantations near Pontypool and Newcastle suffering severe damage.

| | | | |
|------------------|---|--------------|---|
| Lake Erie..... | 8 | Lindsay..... | 4 |
| Lake Huron..... | 7 | Tweed..... | 3 |
| Lake Simcoe..... | 4 | | |

Pine Root Collar Weevil, *Hylobius radialis* Buch.—Infestations of this destructive insect persisted in virtually the same parts of the Lake Simcoe, Pembroke and Parry Sound districts as in 1958 and caused further mortality of Scots pine trees. Small numbers of red pine trees have also been killed in Simcoe County where this weevil was first reported in Ontario. Several new pockets of infestation were found within the general limits established in 1958 in the northern part of the Lake Simcoe District and the southeastern part of the Pembroke District.

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.)—Infestations of this aspen defoliator have persisted in central Ontario since the outbreaks of 1957. Pockets of severe defoliation were centred in Township 175 and Eastern Township, Sault Ste. Marie District; in Township 8F, Chapleau District; and in several areas in the Gogama District. In the Sudbury District, although a downward trend was general throughout the southern half, infestations that has waned in the western part in 1958 increased in 1959, and a new heavy infestation was noted in Division 76. Elsewhere infestations disappeared or were reduced to light intensity.

| | | | |
|-------------------|----|-----------------------|----|
| Chapleau..... | 12 | North Bay..... | 3 |
| Cochrane..... | 1 | Port Arthur..... | 7 |
| Fort Frances..... | 2 | Sault Ste. Marie..... | 9 |
| Geraldton..... | 2 | Sudbury..... | 11 |
| Gogama..... | 9 | Swastika..... | 1 |
| Lake Huron..... | 2 | White River..... | 10 |
| Lake Simcoe..... | 3 | | |

Jack-pine Budworm, *Choristoneura pinus* Free.—Typical of its sporadic occurrence in northern Ontario, only small numbers of larvae were collected by beating in parts of the Sault Ste. Marie and Sudbury districts where defoliation was noticeable in 1958. In contrast, five heavy infestations developed in the Fort Frances District. The largest of these, about 50 square miles in area, was observed near Lowry, Lowe, Huron and Tesup lakes. The four others were in Farrington Township, west of Beaverhouse Lake, east of Atikokan, and east of Jean Lake.

| | | | |
|-------------------|----|-----------------------|---|
| Chapleau..... | 1 | Lake Simcoe..... | 2 |
| Fort Frances..... | 10 | Lindsay..... | 1 |
| Kenora..... | 4 | Sault Ste. Marie..... | 7 |
| Lake Erie..... | 1 | Sioux Lookout..... | 1 |
| Lake Huron..... | 1 | Sudbury..... | 5 |

Red-headed Pine Sawfly, *Neodiprion lecontei* (Fitch)—Damage by this serious pest of hard pines was considerably less severe than in 1958. The decline in southern Ontario resulted, in some areas, from natural causes, in others from chemical control measures which have proved to be economically feasible in young plantations.

The largest areas of heavy infestation were in plantations in the Uxbridge Forest and in Albion Township, Lake Simcoe District, and in Manvers Township, Lindsay District. In all three plantings well-timed chemical sprayings prevented severe defoliation. Scattered heavy infestations were observed in the Lake Huron, Lake Simcoe, Lindsay, and Kemptville districts. In Vespra Township, Lake Simcoe District, 25-foot red pine trees were infested with an average of 32 colonies per tree. No heavy infestations were reported in the Tweed District in 1959. In central Ontario, pockets of heavy infestation occurred in the North Bay and Sudbury districts and along Highway 17 in the Sault Ste. Marie District. In the last two districts the number of infestations declined compared with 1958.

| | | | |
|------------------|----|-----------------------|----|
| Kemptville..... | 5 | Parry Sound..... | 15 |
| Lake Huron..... | 3 | Pembroke..... | 5 |
| Lake Simcoe..... | 8 | Sault Ste. Marie..... | 8 |
| Lindsay..... | 14 | Sudbury..... | 6 |
| North Bay..... | 9 | Tweed..... | 9 |

Swaine Jack-pine Sawfly, *Neodiprion swainei* Midd.—This insect caused severe defoliation of jack pine trees in numerous areas in northern Ontario. As a rule, trees along rocky shorelines and on islands were most severely infested, but some mature stands on good sites were also affected.

High population levels persisted in the Temagami and Rabbit lakes area, North Bay District; at Banks Lake, Swastika District; and on an island in

Minisinakwa Lake, Gogama District. Pockets of medium to heavy infestation of more recent origin occurred in Law Township south of Lake Temagami, at Onaping Lake in the Sudbury District, in three areas in the southeastern part of the Chapleau District, and at Sabaskong Bay on Lake of the Woods. Light to medium infestations built up in mature jack pine stands in the Mississagi River area east of Sault Ste. Marie.

In contrast a decline was reported in the southern part of the Sudbury District, in Somme and Chester townships in the Gogama District, and south of Kindiogami Lake in the Sault Ste. Marie District.

| | | | |
|-------------------|----|-----------------------|----|
| Chapleau..... | 13 | Sault Ste. Marie..... | 17 |
| Fort Frances..... | 2 | Sioux Lookout..... | 2 |
| Gogama..... | 21 | Sudbury..... | 32 |
| North Bay..... | 16 | Swastika..... | 7 |
| Parry Sound..... | 3 | | |

Introduced Pine Sawfly, *Diprion similis* (Htg.)—Small numbers of this sawfly were collected by beating white and Scots pine trees and by searching for cocoons. The known range extends over parts of 12 counties in the Lake Huron and Lake Simcoe districts, bounded roughly by the cities of Hamilton and Toronto in the south and the villages of Markdale and Mildmay in the north. No change in distribution has been noted since 1950.

| | | | |
|-----------------|---|------------------|----|
| Lake Huron..... | 7 | Lake Simcoe..... | 19 |
|-----------------|---|------------------|----|

Black-headed Jack-pine Sawfly, *Neodiprion pratti banksianae* Roh.—Only single or small groups of jack pine trees were severely defoliated during the early summer of 1959. Small pockets of heavy infestation persisted in Humphrey Township, Parry Sound District; on a small island in Rainy Lake, Fort Frances District; and on two small islands in Lake Nipissing, North Bay District. Several years of severe defoliation in the last-named area has caused almost 100 per cent mortality of jack pine trees. Medium to heavy infestations occurred at widely separated locations as follows: Nestor Falls, Kenora District; Monck and Ryerson townships, Parry Sound District; on shelterbelt trees at three locations in the northern part of the Lake Simcoe District; in Glenelg Township, Lake Huron District; and along Highway 29 in Kitley Township, Kemptville District. Light infestations were observed at numerous other points.

| | | | |
|-------------------|----|--------------------|----|
| Chapleau..... | 8 | North Bay..... | 7 |
| Fort Frances..... | 15 | Parry Sound..... | 22 |
| Kemptville..... | 5 | Pembroke..... | 10 |
| Kenora..... | 6 | Sioux Lookout..... | 11 |
| Lake Huron..... | 5 | Sudbury..... | 10 |
| Lake Simcoe..... | 6 | Tweed..... | 5 |
| Lindsay..... | 3 | | |

Red-pine Sawfly, *Neodiprion nanulus nanulus* Schedl—As in 1958, population levels of this insect were generally low. Light infestations were reported at widely separated points throughout northern and central Ontario. Local increases occurred in the central part of the Chapleau District and in several townships in the eastern half of the Pembroke District. A review of counts made at sample points showed that the highest numbers occurred in Panet Township, Chapleau District, where an average of 5 colonies per tree was observed.

| | | | |
|-------------------|----|-----------------------|----|
| Chapleau..... | 15 | Parry Sound..... | 2 |
| Fort Frances..... | 7 | Pembroke..... | 10 |
| Gogama..... | 1 | Port Arthur..... | 11 |
| Kapuskasing..... | 7 | Sault Ste. Marie..... | 1 |
| Kenora..... | 5 | Sioux Lookout..... | 6 |
| Kemptville..... | 1 | Sudbury..... | 4 |
| Lindsay..... | 2 | White River..... | 16 |
| North Bay..... | 5 | | |

Red-headed Jack-pine Sawfly, *Neodiprion virginianus* complex—This insect was more common in northern Ontario except in the Fort Frances and Sudbury districts where it was less abundant than in 1958. Characteristically, only single or small groups of jack pine trees were infested.

Typical pockets of medium to heavy infestation occurred at the following locations: Willingdon and Diamond townships, Kenora District; Newmarket and Dyer townships, Cochrane District; along the Canadian Pacific Railway west of Chapleau; at Minisinakwa Lake, Gogama District; and near Ardbeg, Parry Sound District. The highest counts recorded were in Dyer Township, Cochrane District, and at Still River, Parry Sound District, where larval colonies per tree averaged 24 and 16 respectively.

| | | | |
|-------------------|----|-----------------------|----|
| Chapleau..... | 31 | Lindsay..... | 38 |
| Cochrane..... | 20 | North Bay..... | 11 |
| Fort Frances..... | 15 | Parry Sound..... | 10 |
| Geraldton..... | 13 | Port Arthur..... | 34 |
| Gogama..... | 20 | Sault Ste. Marie..... | 5 |
| Kapuskasing..... | 11 | Sioux Lookout..... | 22 |
| Kenora..... | 6 | Sudbury..... | 14 |
| Lake Simcoe..... | 2 | Swastika..... | 7 |

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.)—For the third consecutive year, defoliation was recorded farther north than previously. The most northerly collections received in 1959 were from Fenwick, Kelso, and Eby townships in the Sault Ste. Marie, Chapleau, and Swastika districts respectively. Pockets of severe defoliation were common from the Sault Ste. Marie, Sudbury, and North Bay districts south to Lake Ontario and Lake Erie.

| | | | |
|------------------|---|-----------------------|----|
| Chapleau..... | 1 | Parry Sound..... | 12 |
| Kemptville..... | 2 | Pembroke..... | 3 |
| Lake Erie..... | 1 | Sault Ste. Marie..... | 6 |
| Lake Huron..... | 6 | Sudbury..... | 6 |
| Lake Simcoe..... | 3 | Swastika..... | 6 |
| Lindsay..... | 8 | Tweed..... | 1 |
| North Bay..... | 9 | | |

Balsam-fir Sawfly, *Neodiprion abietis* complex—There was a general increase in the numbers of sawflies on balsam fir across Ontario. In the Southeastern Region, medium to heavy infestations persisted in Bangor Township, Tweed District and in Bathurst Township, Kemptville District, and new pockets of light to medium infestation were observed in Horton and McNab townships in the former district. Balsam fir trees at numerous points in the Lindsay District and at three locations in the Pembroke District suffered light defoliation. In the Lake Huron District pockets of medium to heavy infestation occurred in Osprey, Glenelg and Artemesia townships. The most abrupt increase was recorded in the Batchewana Bay area north of Sault Ste. Marie where roadside trees in particular were heavily infested. To the east, light infestations occurred along Highway 17 in Plummer Township and at two locations on Manitoulin Island. The insect was also more common in the Western Region than in recent years. Colony counts made in six forest districts are shown in the following table.

| District | No. of sample points | No. of colonies per tree | |
|-----------------------|----------------------|--------------------------|---------|
| | | Highest | Average |
| Fort Frances..... | 2 | 2 | 2 |
| Sault Ste. Marie..... | 3 | 23 | 11 |
| Sudbury..... | 4 | 7 | 3 |
| Pembroke..... | 3 | 7 | 4 |
| Lindsay..... | 5 | 9 | 5 |
| Tweed..... | 5 | 50+ | 14 |

European Spruce Sawfly, *Diprion hercyniae* (Htg.)—Only slight changes were recognized in the distribution and numbers of this sawfly.

| | | | |
|-------------------|----|-----------------------|----|
| Cochrane..... | 2 | North Bay..... | 14 |
| Fort Frances..... | 6 | Parry Sound..... | 19 |
| Gogama..... | 5 | Pembroke..... | 21 |
| Kemptville..... | 9 | Sault Ste. Marie..... | 25 |
| Lake Erie..... | 2 | Sudbury..... | 22 |
| Lake Huron..... | 4 | Swastika..... | 5 |
| Lake Simcoe..... | 12 | Tweed..... | 20 |
| Lindsay..... | 8 | | |

Yellow-headed Spruce Sawfly, *Pikonema alaskensis* (Roh.)—Open-grown white and black spruce trees at many locations in Ontario were infested by this perennial pest. Although pockets of heavy infestation occurred in all districts, the number of areas in central and northern Ontario so affected were more numerous than in 1958.

| | | | |
|-------------------|----|-----------------------|----|
| Chapleau..... | 12 | North Bay..... | 10 |
| Cochrane..... | 13 | Parry Sound..... | 17 |
| Fort Frances..... | 7 | Pembroke..... | 18 |
| Geraldton..... | 10 | Port Arthur..... | 14 |
| Gogama..... | 39 | Sault Ste. Marie..... | 46 |
| Kapuskasing..... | 18 | Sioux Lookout..... | 38 |
| Kemptville..... | 11 | Sudbury..... | 43 |
| Kenora..... | 15 | Swastika..... | 20 |
| Lake Huron..... | 17 | Tweed..... | 16 |
| Lake Simcoe..... | 7 | White River..... | 11 |
| Lindsay..... | 14 | | |

Balsam Bud-mining Sawfly, *Pleroneura borealis* Felt—The incidence of this tiny insect on the new shoots of balsam fir was lower than in 1958. This decline was most evident in the Fort Frances, Sault Ste. Marie, Sudbury, Pembroke and Parry Sound districts. For example, in the last two districts named, the percentage of infested shoots at representative sample points in 1958 and 1959 dropped from 13 and 11 to 2 and 3 respectively.

| | | | |
|-------------------|---|-----------------------|----|
| Chapleau..... | 4 | North Bay..... | 13 |
| Cochrane..... | 1 | Parry Sound..... | 16 |
| Fort Frances..... | 4 | Pembroke..... | 13 |
| Geraldton..... | 1 | Port Arthur..... | 2 |
| Gogama..... | 5 | Sault Ste. Marie..... | 1 |
| Lake Simcoe..... | 1 | Sudbury..... | 5 |
| Lindsay..... | 1 | Tweed..... | 1 |

Jack-pine Needle Miner, *Exoteleia pinifoliella* (Cham.)—Scattered medium to heavy infestations were reported on jack pine trees in the Sault Ste. Marie, Sudbury, Parry Sound, Lake Huron, Lake Erie, Lindsay and Kemptville districts.

| | | | |
|------------------|----|-----------------------|---|
| Chapleau..... | 1 | Lindsay..... | 7 |
| Kemptville..... | 3 | North Bay..... | 6 |
| Kenora..... | 9 | Parry Sound..... | 5 |
| Lake Erie..... | 10 | Sault Ste. Marie..... | 3 |
| Lake Huron..... | 5 | Sudbury..... | 4 |
| Lake Simcoe..... | 6 | | |

A Leaf Miner on Birch, *Profenusa thomsoni* (Konow)—High population levels of this leaf-mining sawfly that have been recorded in the Northern and Central regions for several years persisted and several new areas of infestation were reported. Severe browning of white birch foliage was obvious again in 1959 in Whitney Township, Cochrane District; at Remi Lake, Kapuskasing District; at Elk Lake, Swastika District; and in the Anjigama Lake area as well as north of Batchewana Bay, Sault Ste. Marie District. Severe browning was noted for the first time in Glackmeyer Township, Cochrane District; in Cook

Township, Swastika District; and on the western half of Manitoulin Island. The infestation intensity based on the number of mines in 100 leaves is shown for four locations in the following table.

| Location | Per cent of leaves infested | No. of mines per leaf |
|-----------------------|-----------------------------|-----------------------|
| Whitney Township..... | 80 | 1.8 |
| Remi Lake..... | 63 | 1.8 |
| Elk Lake..... | 92 | 2.3 |
| Anjigami Lake..... | 93 | 10+ |

| | | | |
|------------------|----|-----------------------|----|
| Chapleau..... | 20 | North Bay..... | 17 |
| Cochrane..... | 5 | Parry Sound..... | 7 |
| Gogama..... | 14 | Pembroke..... | 7 |
| Kapuskasing..... | 3 | Sault Ste. Marie..... | 14 |
| Kemptville..... | 2 | Sudbury..... | 21 |
| Lindsay..... | 3 | Swastika..... | 11 |
| Lake Huron..... | 2 | White River..... | 7 |

Birch Leaf Miner, *Fenusa pusilla* (Lep.)—As in previous years, pockets of heavy infestation were found more commonly in the North Bay, Pembroke, Kemptville and Tweed districts than elsewhere throughout its range in central and southern Ontario.

| | | | |
|------------------|----|------------------|----|
| Lake Erie..... | 2 | Parry Sound..... | 7 |
| Lake Huron..... | 3 | Pembroke..... | 12 |
| Lake Simcoe..... | 2 | Sudbury..... | 6 |
| Lindsay..... | 6 | Swastika..... | 1 |
| Kemptville..... | 9 | Tweed..... | 3 |
| North Bay..... | 23 | | |

Elm Leaf Miner, *Fenusa ulmi* Sund.—Pockets of heavy infestation were found in three districts as follows: Derby Township in Lake Huron, Hamilton, Bexley, Ops, and Sommerville townships in Lindsay, and Rowden Township in Tweed.

| | | | |
|-----------------|---|------------|---|
| Lake Huron..... | 2 | Tweed..... | 2 |
| Lindsay..... | 7 | | |

A Leaf-folding Sawfly, *Nematus* sp.—The frequency of occurrence of this undescribed leaf-folding sawfly on poplar has fluctuated considerably during the past decade. The following data, based on the examination of 100 trembling aspen leaves from young trees show the frequency of attack and the general level of abundance in 1959.

| District | Average number of folds per 100-leaf sample | District | Average number of folds per 100-leaf sample |
|-----------------------|---|------------------|---|
| Sioux Lookout..... | 9 | Chapleau..... | 5 |
| Kenora..... | 13 | Gogama..... | 13 |
| Fort Frances..... | 4 | North Bay..... | 6 |
| Port Arthur..... | 26 | Pembroke..... | 84 |
| Geraldton..... | 14 | Parry Sound..... | 41 |
| Kapuskasing..... | 16 | Lake Huron..... | 20 |
| Cochrane..... | 17 | Lake Erie..... | 46 |
| Swastika..... | 19 | Lindsay..... | 68 |
| Sault Ste. Marie..... | 11 | Tweed..... | 63 |
| Sudbury..... | 18 | Kemptville..... | 12 |
| White River..... | 1 | | |

A Birch Leaf Miner, *Nepticula* sp.—As far as is known this leaf miner is undescribed. During 1958 and 1959, heavy infestations caused severe browning of white birch foliage on Bruce Peninsula in the Lake Huron District. Collections were also received during late summer and fall from Parry Sound District and the southern tip of Manitoulin Island, Sudbury District.

Birch Skeletonizer, *Bucculatrix canadensisella* Cham.—Skeletonizing of white birch foliage increased considerably from the southern parts of the Sault Ste. Marie and Sudbury districts east and south throughout southern Ontario. Notable among the many white birch stands affected were those on Manitoulin Island; in townships surrounding Lake Couchiching, Lake Simcoe District; in the most southerly row of townships of the Pembroke District extending into the northeastern corner of Haliburton County and into the northern part of the Tweed District; in the northern part of the Lake Huron District, particularly on Bruce Peninsula; and in an area comprised of five townships in Norfolk County, Lake Erie District, where some infestations have persisted for four consecutive years.

| | | | |
|------------------|---|-----------------------|---|
| Lake Erie..... | 2 | Sault Ste. Marie..... | 2 |
| Lake Huron..... | 8 | Sudbury..... | 5 |
| Lake Simcoe..... | 1 | Tweed..... | 5 |
| Pembroke..... | 1 | | |

Spruce Bud Moth, *Zeiraphera ratzeburgiana* Ratz.—This insect was again abundant on the new shoots of spruce trees at widely separated localities. Severe damage occurred in the Garden River Reservation and in Thompson Township east of Sault Ste. Marie. Population levels increased in the Sudbury District, with heavy infestations occurring in Dowling and Balfour townships as well as on parts of Manitoulin Island. In southern Ontario moderate to severe damage was observed west of Commanda, Parry Sound District, and on isolated spruces at one location in Carden Township, Lindsay District.

| | | | |
|------------------|---|-----------------------|---|
| Kenora..... | 1 | Port Arthur..... | 9 |
| Lindsay..... | 1 | Sault Ste. Marie..... | 1 |
| North Bay..... | 3 | Sudbury..... | 2 |
| Parry Sound..... | 3 | Swastika..... | 1 |

Larch Casebearer, *Coleophora laricella* (Hbn.)—Population levels throughout the southern half of Ontario have continued to decline since 1952 when the last widespread infestations were reported. Counts at four sample points in the Lake Simcoe District, for example, showed an average of 34 larvae per branch tip in 1952 compared with only 5 in 1959. The only medium or heavy infestations reported were on European larch in the Sandy Hill Tract, Lake Huron District, and on native and European larch trees at two points in the Lake Erie District.

| | | | |
|------------------|----|-----------------------|---|
| Kemptville..... | 3 | Parry Sound..... | 8 |
| Lake Erie..... | 4 | Pembroke..... | 9 |
| Lake Huron..... | 16 | Port Arthur..... | 6 |
| Lake Simcoe..... | 12 | Sault Ste. Marie..... | 6 |
| Lindsay..... | 5 | Sudbury..... | 5 |
| North Bay..... | 7 | Tweed..... | 1 |

A Pine Tip Moth, *Rhyacionia adana* Heinr.—This insect was found on small Scots, red, and jack pine trees at 22 locations. In Lake Simcoe District, a heavy infestation persisted in a red pine plantation near Stayner and moderate damage occurred in Medonte and Flos townships. In the Lake Huron District, examination of 100 trees in a young Scots pine planation in Glenelg Township revealed the presence of 143 infested shoots on 59 trees. Medium infestations occurred in Lutterworth and Clarke townships in the Lindsay District.

| | | | |
|-----------------|---|-----------------------|---|
| Chapleau..... | 6 | Parry Sound..... | 3 |
| Kenora..... | 1 | Sault Ste. Marie..... | 1 |
| Lake Huron..... | 3 | Sudbury..... | 3 |
| Lindsay..... | 5 | | |

White-pine Shoot Borer, *Eucosma gloriola* Heinr.—Numerous pine plantations in central and southern Ontario showed brown 'flagging' symptomatic of the attack by this shoot borer. Compared with 1958 there was little change

in the frequency of attack except in the Lake Erie District where Christmas tree plantations in the St. Williams-Courtland area of Norfolk County harboured heavy infestations. In one Scots pine plantation as high as 30 affected shoots were counted on an 8-foot tree and most trees, even in the 2-foot-height class, had one or more infested shoots.

This insect attacks Scots, red, white, Austrian, Mugho pines in much the same way, that is tips of the lateral branches of open-growing trees are preferred. With jack pine, the same insect or a closely related species prefers the terminal or the leading shoots of the top whorl of branches. Jack pine is the only recorded host in the Kenora and Fort Frances districts where there was slight change in its overall abundance.

| | | | |
|-------------------|---|-----------------------|----|
| Fort Frances..... | 3 | Lake Simcoe..... | 12 |
| Kemptville..... | 1 | Parry Sound..... | 7 |
| Kenora..... | 2 | Sault Ste. Marie..... | 2 |
| Lake Erie..... | 5 | Sioux Lookout..... | 1 |
| Lake Huron..... | 8 | Sudbury..... | 2 |

Larch Shoot Moth, *Argyresthia laricella* Kft.—This little-known insect occurs in small numbers on native larch trees throughout Ontario. The extensive damage to European larch trees in a plantation near St. Williams in the Lake Erie District indicated it to be a more serious pest of this tree than of tamarack. An average of 140 dead shoots per tree was counted on trees ranging from 23 to 28 feet high.

| | | | |
|-------------------|---|-----------------------|---|
| Chapleau..... | 2 | Lake Simcoe..... | 5 |
| Cochrane..... | 1 | Lindsay..... | 7 |
| Fort Frances..... | 6 | North Bay..... | 1 |
| Kapuskasing..... | 1 | Parry Sound..... | 1 |
| Kemptville..... | 4 | Sault Ste. Marie..... | 1 |
| Kenora..... | 2 | Sioux Lookout..... | 2 |
| Lake Erie..... | 4 | Sudbury..... | 1 |
| Lake Huron..... | 6 | Tweed..... | 4 |

Black-headed Budworm, *Acleris variana* (Fern.)—An upward trend in population levels of this insect on balsam fir and spruce has been apparent for at least two years. This is reflected by the number of collections received from 1957 to 1959 shown in the following table where districts are listed from west to east to south. Most noteworthy increases occurred in the North-Central and South-Central regions, especially in divisions 29 and 67 of the Chapleau and Sudbury districts respectively.

| District | Number of Collections | | |
|-----------------------|-----------------------|------|------|
| | 1957 | 1958 | 1959 |
| Sioux Lookout..... | 2 | 1 | 1 |
| Kenora..... | 2 | 1 | 0 |
| Fort Frances..... | 2 | 1 | 0 |
| Port Arthur..... | 1 | 2 | 2 |
| Geraldton..... | 2 | 1 | 2 |
| Kapuskasing..... | 0 | 1 | 1 |
| Cochrane..... | 2 | 1 | 1 |
| White River..... | 0 | 3 | 5 |
| Chapleau..... | 0 | 2 | 22 |
| Gogama..... | 0 | 4 | 16 |
| Swastika..... | 2 | 2 | 8 |
| Sault Ste. Marie..... | 1 | 3 | 13 |
| Sudbury..... | 0 | 5 | 14 |
| North Bay..... | 1 | 5 | 5 |
| Parry Sound..... | 4 | 4 | 14 |
| Pembroke..... | 1 | 5 | 8 |
| Lake Huron..... | 0 | 0 | 0 |
| Lake Simcoe..... | 0 | 2 | 1 |
| Lindsay..... | 0 | 2 | 0 |
| Tweed..... | 0 | 0 | 4 |
| Kemptville..... | 1 | 2 | 0 |
| Lake Erie..... | 0 | 0 | 0 |
| | 19 | 48 | 117 |

A Tortricid on Oak, *Argyrotoxa semipurpurana* Kft.—Severe defoliation of red oak trees occurred in three districts during late spring and early summer. In the Sault Ste. Marie District, the Gros Cap infestation intensified and extended eastward in a narrow band for a distance of 10 miles through Prince and Korah townships. In the Lake Simcoe District, 10 acres of 80-foot trees in the Dufferin County Forest were completely defoliated. In the Lindsay District, the heavy infestation which occurred in 1958 along the Clarke-Manvers township line increased from 3 to more than 100 acres.

| | | | |
|------------------|---|-----------------------|---|
| Lake Simcoe..... | 1 | Sault Ste. Marie..... | 1 |
| Lindsay..... | 4 | | |

Orange-striped Oakworm, *Anisota senatoria* (J. E. Smith)—Pockets of heavy infestation recurred on various species of oaks in Northumberland, Hastings and Prince Edward counties in the Southeastern Region. In the Lake Erie District, population levels were lower than in 1958 except at Seneca and Glencoe where new infestations were reported. In the Lake Huron District, moderate defoliation occurred in Waterloo, Wentworth, and Oxford counties.

| | | | |
|-----------------|---|--------------|---|
| Lake Erie..... | 3 | Lindsay..... | 2 |
| Lake Huron..... | 4 | Tweed..... | 9 |

Fall Cankerworm, *Alsophila pometaria* (Harr.)—Severe defoliation of elm and maple was reported in West Flamborough Township, Lake Huron District, and of elm in Vespra, Mono, and Adjala townships, Lake Simcoe District. Elsewhere in southern Ontario numerous small pockets of light to medium intensity were found. In the Fort Frances District a further decline in the low numbers reported in 1958 was noted.

| | | | |
|-------------------|---|------------------|----|
| Fort Frances..... | 1 | Lake Huron..... | 12 |
| Kemptville..... | 3 | Lake Simcoe..... | 2 |
| Lake Erie..... | 6 | Lindsay..... | 1 |

Fall Webworm, *Hyphantria cunea* (Drury)—A marked reduction in the numbers of collections received from some districts in northern Ontario indicated that colonies were more difficult to find in 1959. Pockets of heavy infestation did occur in the Kenora, Fort Frances, Lindsay, Tweed, and Kemptville districts. Based on web counts the insect was most abundant in Otonabee, Sidney, and Madoc townships in southeastern Ontario.

| | | | |
|-------------------|----|-----------------------|----|
| Chapleau..... | 2 | North Bay..... | 5 |
| Cochrane..... | 13 | Parry Sound..... | 17 |
| Fort Frances..... | 1 | Pembroke..... | 9 |
| Kemptville..... | 12 | Sault Ste. Marie..... | 7 |
| Kenora..... | 3 | Sioux Lookout..... | 1 |
| Lake Erie..... | 15 | Sudbury..... | 6 |
| Lake Huron..... | 19 | Tweed..... | 16 |
| Lake Simcoe..... | 5 | White River..... | 2 |
| Lindsay..... | 6 | | |

Walnut Caterpillar, *Datana integerrima* G. and R.—There was a further decrease in the number and severity of infestations on black walnut in the South-western Region and the Lindsay District in 1959. Defoliation of hickory trees in the Tweed District increased. Infestations at numerous points in the Lake Erie District were reduced generally to light intensity and in the Lake Huron District to localized infestations in Huron and Halton counties. Only one heavy infestation was noted in Monaghan Township, Lindsay District. Moderate to severe defoliation of hickory trees prevailed in townships surrounding the Bay of Quinte as well as in the southern part of Prince Edward County, Tweed District.

| | | | |
|------------------|---|--------------|---|
| Lake Erie..... | 6 | Lindsay..... | 1 |
| Lake Huron..... | 5 | Tweed..... | 8 |
| Lake Simcoe..... | 1 | | |

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.—The only known infestation of the forest tent caterpillar was on three small islands in the west arm of Eagle Lake in the Kenora District. Although defoliation of aspen and bur oak trees was less than severe, cocoons were abundant and an unusually high proportion (54 per cent) of the pupae gave rise to moths. Numbers of egg bands on trembling aspen trees, about 4 inches D.B.H., averaged nine per tree. Collections from other widely separated localities across Ontario usually contained only individual larvae or cocoons.

| | | | |
|-------------------|----|-----------------------|---|
| Fort Frances..... | 2 | Port Arthur..... | 1 |
| Kenora..... | 11 | Sault Ste. Marie..... | 1 |
| Lake Erie..... | 8 | Sioux Lookout..... | 3 |
| Lake Huron..... | 3 | Sudbury..... | 1 |

Western Tent Caterpillar, *Malacosoma pluviale* (Dyar)—The general level of western tent caterpillar populations throughout northern Ontario is shown by the following counts of colonies per mile of roadside or, in two instances, per square-chain plot:

| District | No. of locations | Average count | Highest count |
|-----------------------|------------------|---------------|---------------|
| Sioux Lookout..... | 5 | 1 | 6 |
| Kenora..... | 6 | 5 | 13 |
| Fort Frances..... | 5 | 0 | 0 |
| Port Arthur..... | 5 | 1 | 1 |
| Geraldton*..... | 11 | 2 | 4 |
| Kapuskasing..... | 5 | 0 | 0 |
| Cochrane*..... | 11 | 1 | 6 |
| White River..... | 7 | 1 | 2 |
| Chapleau..... | 5 | 2 | 7 |
| Gogama..... | 5 | 2 | 5 |
| Swastika..... | 5 | 1 | 1 |
| Sault Ste. Marie..... | 5 | 1 | 1 |
| Sudbury..... | 5 | 1 | 2 |
| North Bay..... | 5 | 0 | 0 |

*Counts based on square-chain plots.

Eastern Tent Caterpillar, *Malacosoma americanum* (F.)—A general increase in the number of tents counted per mile of roadside was recorded throughout the southern half of its range in Ontario, as shown in the following table.

| District | Counts per mile of roadside | | | | No. of locations | |
|-----------------------|-----------------------------|------|----------------|------|------------------|------|
| | Average Number | | Highest Number | | 1958 | 1959 |
| | 1958 | 1959 | 1958 | 1959 | | |
| Sault Ste. Marie..... | 22 | 1 | 22 | 1 | 1 | 1 |
| Sudbury..... | — | 1 | — | 1 | — | 2 |
| North Bay..... | — | 2 | — | 2 | — | 3 |
| Pembroke..... | — | 6 | — | 14 | — | 9 |
| Parry Sound..... | — | 14 | — | 22 | — | 4 |
| Lake Simcoe..... | 1 | 7 | 3 | 12 | 3 | 4 |
| Lake Huron..... | 8 | 21 | 14 | 63 | 9 | 10 |
| Lake Erie..... | 2 | 3 | 4 | 5* | 5 | 5 |
| Lindsay..... | 4 | 14 | 11 | 84 | 12 | 12 |
| Tweed..... | 2 | 5 | 3 | 10 | 5 | 11 |
| Kemptville..... | 2 | 2 | 3 | 5 | 2 | 6 |

*Exclusive of one count of 52 colonies per square chain in McGillivray Township

Sharp increases in numbers were reported from McAuley and McLean townships in Parry Sound District, and from Brant and Sullivan townships, Lake Huron District. Heavy infestations occurred in McGillivray and Harvey townships in the Lake Erie and Lindsay districts respectively.

A Noctuid, *Enargia decolor* Wlk.—This leaf-tier caused widespread defoliation of trembling aspen stands in the Western Region. The most noteworthy of the many infestations reported were as follows: severe defoliation over more than 100 square miles between Goose and Long-legged lakes in the Sioux Lookout District, moderate to severe defoliation along the Wabigoon River watershed between Clay and Ball lakes in the Kenora District, and at Sakwite Lake and Porter Inlet on Rainy Lake in the Fort Frances District. Heavy moth flights were observed in some of the infested areas in late August.

| | | | |
|-------------------|----|-----------------------|---|
| Chapeau..... | 6 | North Bay..... | 3 |
| Fort Frances..... | 19 | Parry Sound..... | 1 |
| Geraldton..... | 1 | Port Arthur..... | 2 |
| Gogama..... | 3 | Sault Ste. Marie..... | 5 |
| Kapuskasing..... | 1 | Sioux Lookout..... | 6 |
| Kenora..... | 7 | Sudbury..... | 1 |
| Lake Simcoe..... | 2 | | |

European Elm Leaf Beetle, *Galerucella xanthomelaena* (Schr.)—The status of this introduced shade tree pest showed little change in 1959. Pockets of infestation occurred on elms in Lincoln and Welland counties, as well as at St. Thomas, Tecumseh and Amherstburg in the Lake Erie District. Moderate defoliation of Wych elm trees was reported in the town of Cobourg, Lindsay District.

| | | | |
|-----------------|---|--------------|---|
| Lake Erie..... | 7 | Lindsay..... | 1 |
| Lake Huron..... | 1 | | |

White-pine Weevil, *Pissodes strobi* (Peck)—Heavy infestations persisted in many parts of Ontario on several species of coniferous trees. Although open-grown white pine was the preferred host, jack and Scots pine in plantations were also severely attacked. An unusually large number of black spruce trees were infested along Highway 11 between North Bay and Latchford. In comparison with other parts of central and southern Ontario, infestations on pines in the Lake Huron and Lake Erie districts were generally lighter in intensity.

In recent years control with insecticides has been very effective in a number of county forests in southern Ontario. Although re-infestation of host trees sometimes occurs from outside sprayed areas, plantations may, under favourable circumstances, be protected from extensive damage by spraying every second or third year.

| | | | |
|-------------------|----|-----------------------|----|
| Chapeau..... | 7 | Lindsay..... | 10 |
| Cochrane..... | 5 | North Bay..... | 2 |
| Fort Frances..... | 1 | Parry Sound..... | 6 |
| Geraldton..... | 19 | Pembroke..... | 5 |
| Gogama..... | 6 | Port Arthur..... | 7 |
| Kemptville..... | 2 | Sault Ste. Marie..... | 12 |
| Kenora..... | 2 | Sudbury..... | 8 |
| Lake Erie..... | 3 | Swastika..... | 9 |
| Lake Huron..... | 6 | Tweed..... | 2 |
| Lake Simcoe..... | 4 | White River..... | 2 |

An Ambrosia Beetle, *Corthylus punctatissimus* Zimm.—Although recorded previously by the Forest Insect Survey, this beetle is not usually found in the abundance it was in southwestern Ontario in 1959. The insects girdle the trees immediately below ground level by constructing spiral galleries around the stem beneath the cambium. Infested trees break off readily at ground level when pulled or twisted and show the characteristic dark stain caused by the ambrosia fungus. Trees 1-3 feet high were most susceptible. Mortality in this height class was high in numerous woodlots, and in some exceeded 90 per cent. Saplings less than 1 foot in height were seldom attacked, those 3-6 feet high were infrequently infested and less likely to succumb, and older trees were immune.

Surveys conducted since mid-season revealed the presence of this beetle on the Niagara Peninsula, in the northern and eastern two thirds of the Lake Huron District, throughout the Lake Simcoe District, and as far north as South River in the Parry Sound District.

| | | | |
|-----------------|----|------------------|---|
| Lake Erie..... | 2 | Lake Simcoe..... | 3 |
| Lake Huron..... | 18 | Parry Sound..... | 3 |

Northern Pine Weevil, *Pissodes approximatus* Hopk.—This weevil remained a serious pest in southern Ontario where partial cropping of Scots pine plantations for Christmas trees has been practised. Feeding by the adults in late summer and fall, and again the following spring, causes browning of the foliage and a consequent loss in grade. Infestations were particularly heavy in the northern part of the Lake Simcoe District and in Durham County in the Lindsay District. Because of control measures undertaken in the Lake Erie District, damage was less severe in 1959 than anticipated.

Pales Weevil, *Hylobius pales* (Hbst.)—This beetle also continues to present a serious threat to Christmas tree plantations that have had partial crops removed. Damage in 1959 was restricted mainly to the Lake Erie, Lake Simcoe, Lindsay and Parry Sound districts. Chemical control measures in late summer have helped to reduce the amount of damage to trees ready for harvest.

Smaller European Elm Bark Beetle, *Scolytus multistriatus* (Marsh.)—Several noteworthy extensions in the known distribution of this introduced vector of the Dutch elm disease have resulted from an intensified survey for elm bark beetles in southern Ontario. It is now known to range from Pelee Island in the south, throughout the Lake Erie District, as far north in the Lake Huron District as Paisley in Bruce County, Egremont Township in Grey County, and along the shore of Lake Ontario east as far as Colborne. The examination of suitable brood material such as dead trees, logs, fuelwood and slash proved to be a more productive survey method than the trap log procedure previously employed.

| | | | |
|-----------------|----|------------------|---|
| Lake Erie..... | 1 | Lake Simcoe..... | 2 |
| Lake Huron..... | 11 | Lindsay..... | 6 |

Oak Twig Pruner, *Elaphidion parallelum* Newn.—Pockets of heavy infestation of this twig pruner occurred on red oak trees at numerous locations in the northern part of Simcoe and Ontario counties, Lake Simcoe District, and in Laxton, Dummer, and Clarke townships, Lindsay District. These infestations were characterized by the litter of pruned twigs on the ground beneath infested trees. Light damage to red oak trees was observed commonly in the Parry Sound District.

| | | | |
|------------------|---|------------------|----|
| Kemptville..... | 1 | Lindsay..... | 13 |
| Lake Erie..... | 1 | Parry Sound..... | 6 |
| Lake Simcoe..... | 8 | | |

Walkingstick, *Diapheromera femorata* (Say)—A 100-acre red oak stand in Uxbridge Township, Lake Simcoe District was completely defoliated. Light defoliation was noted at two other points in that district and near Cape Croker on Bruce Peninsula.

| | | | |
|-----------------|---|------------------|---|
| Lake Erie..... | 1 | Lake Simcoe..... | 4 |
| Lake Huron..... | 1 | Lindsay..... | 3 |

Pine Thrips, *Gnaphothrips piniphilus* Cwfd.—Collections of thrips from jack pine and less frequently from Scots and red pine were made in nine districts. Collections received during the past three years suggest this species occurs throughout Ontario.

| | | | |
|------------------|---|-----------------------|---|
| Chapleau..... | 5 | Parry Sound..... | 1 |
| Gogama..... | 1 | Sault Ste. Marie..... | 1 |
| Kenora..... | 3 | Sioux Lookout..... | 1 |
| Lake Simcoe..... | 1 | Sudbury..... | 1 |
| North Bay..... | 1 | | |

Pine Spittlebug, *Aphrophora parallela* (Say)—Collections of this spittlebug were received from all but two districts. Further Scots pine tree mortality was reported in Vivian Forest, Lake Simcoe District, where a heavy infestation persists. Damage to Scots, jack or white pines ranging from thinning of the foliage to branch mortality was reported from the North Bay, Lake Huron, and Tweed districts.

| | | | |
|-------------------|---|-----------------------|---|
| Chapleau..... | 4 | North Bay..... | 7 |
| Cochrane..... | 1 | Parry Sound..... | 7 |
| Fort Frances..... | 3 | Pembroke..... | 1 |
| Geraldton..... | 1 | Port Arthur..... | 7 |
| Gogama..... | 5 | Sault Ste. Marie..... | 8 |
| Kapuskasing..... | 2 | Sioux Lookout..... | 1 |
| Kenora..... | 1 | Sudbury..... | 2 |
| Lake Huron..... | 2 | Swastika..... | 1 |
| Lake Simcoe..... | 3 | Tweed..... | 1 |
| Lindsay..... | 7 | White River..... | 1 |

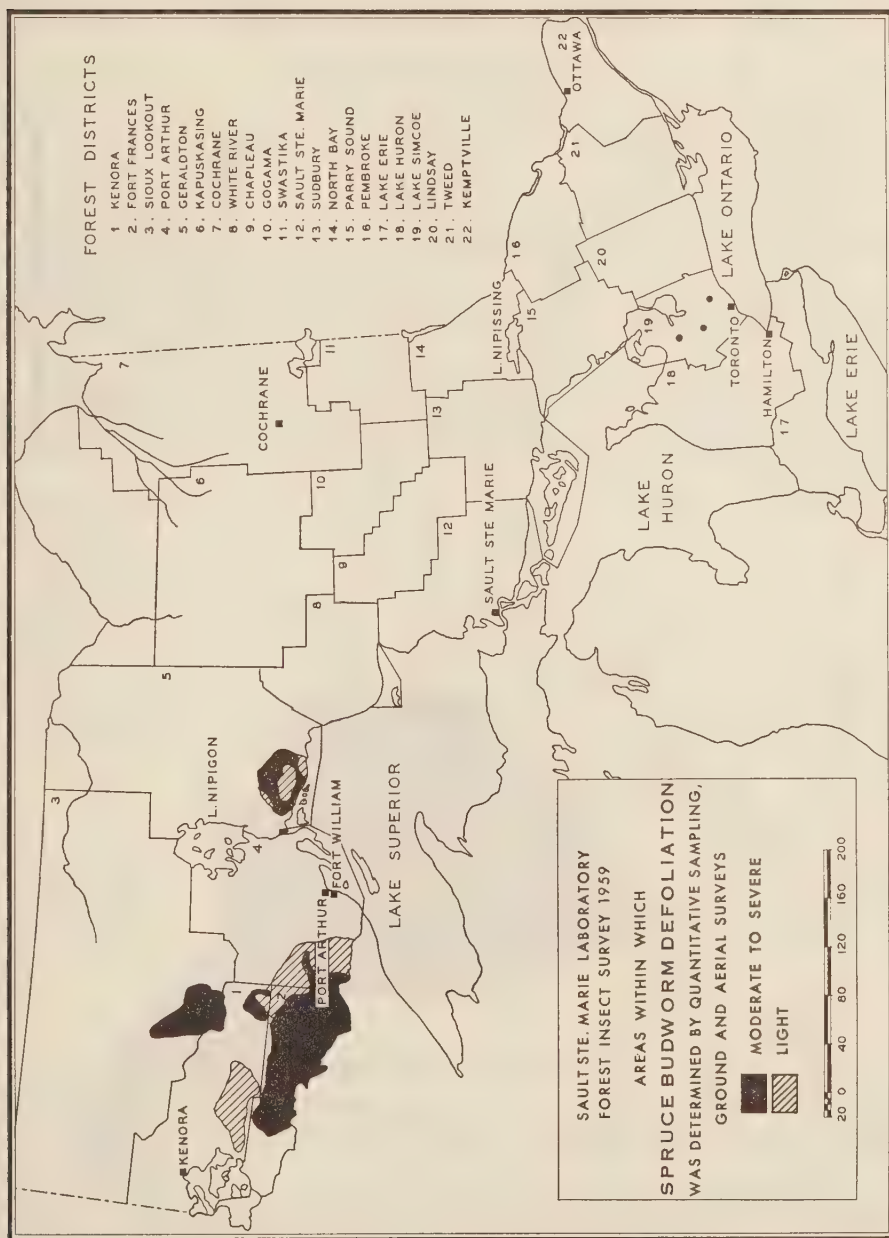
A Spider Mite, *Oligonychus* sp.—Infestations of spider mites on red juniper trees in Point Pelee National Park, Lake Erie District, have been greatly reduced by the application of miticide sprays, but the 1958 outbreak did cause some tree mortality near the tip of the Point. In 1959, red juniper along the shore of Lake Erie in Essex and Kent counties, and Norway and white spruce as well as juniper along the Queen Elizabeth Way between St. Catharines and Hamilton were heavily infested.

OTHER NOTEWORTHY INSECTS

| Insect | Host | District | Remarks |
|--------------------------------------|----------------------|------------------------------------|---|
| <i>Altica ulmi</i> Woods | Elm, white | Lake Erie, Lake Huron, Lake Simcoe | Moderate to severe defoliation. |
| <i>Anacampsis innocuella</i> Zell. | Aspen, trembling | Sudbury | Heavy defoliation in some localities. |
| <i>Anisota rubicunda</i> (Fabr.) | Maple, red | — | Low population levels throughout range of maple. |
| <i>Archips cerasivoranus</i> (Fitch) | Cherry, willow, etc. | — | Recorded from all districts. |
| <i>Arge pectoralis</i> (Leach) | Birch, white | Lindsay, Tweed | Severe defoliation at several locations. |
| <i>Baliosus ruber</i> (Web.) | Basswood | Lindsay, Lake Erie | Heavy infestations in Smith and Harvey townships, and near Hyde Park. |
| <i>Coleophora ulmifoliella</i> McD. | Elm, white | Lake Huron | Severe damage at two locations. |
| <i>Conophthorus resinosae</i> Hopk. | Pine, red | Lindsay | New shoots heavily damaged at Kenisis Lake. |
| <i>Corythucha</i> sp. | Basswood, elm, etc. | Lindsay | Severe browning at several locations. |
| <i>Dasyneura balsamicola</i> (Lint.) | Fir, balsam | Parry Sound | Severe damage near Cheswick. |

OTHER NOTEWORTHY INSECTS—Concluded

| Insect | Host | District | Remarks |
|--|-------------------------|---|---|
| <i>Datana ministra</i> (Drury) | Hawthorn | Lindsay | Heavy defoliation in Cartwright Township. |
| <i>Episimus argutatus</i> Clem. | Sumac | Lake Erie | Heavy defoliation at two points. |
| <i>Erannis tiliaria</i> (Harr.) | Maple, red and sugar | Lake Simcoe | Moderate defoliation near Reddickville. |
| <i>Exoteleia dodecella</i> Linn. | Pine, Scots. | Lake Huron, Kemptville | Pockets of heavy defoliation. |
| <i>Hemichroa crocea</i> (Fourc.) | Birch and alder | Kenora, Sudbury, Pembroke | Heavy infestations. |
| <i>Lecanium corni</i> Bouché | Oak and basswood | Lake Erie | Heavy infestations. |
| <i>Lepidosaphes ulmi</i> (Linn.) | Poplar, ash, etc. | Lake Erie | Heavy infestations. |
| <i>Lithocolletis salicifoliella</i> Cham. | Aspen, trembling | Fort Frances, Chapleau, Sudbury, Lake Huron | Heavy infestations. |
| <i>Ocnerostoma piniariella</i> Zell. | Pine, red and white | Sudbury, North Bay, Lake Erie | Heavy infestations. |
| <i>Paraclemensia acerifoliella</i> (Fitch) | Maple, red and sugar | Kemptville, Tweed | Localized infestations. |
| <i>Plagiodera versicolora</i> Laich. | Willow | Lindsay | Clumps of trees heavily infested. |
| <i>Pulvinaria innumerabilis</i> (Rathv.) | Elm, white | Lake Erie | Pockets of heavy infestation. |
| <i>Recurvaria canusella</i> Free. | Pine, jack | Lake Erie | Pockets of heavy infestation. |
| <i>Rhabdophaga swainnei</i> Felt | Spruce, white and black | Sudbury | Small areas of heavy infestation. |
| <i>Toumeyella numismaticum</i> (P. & M.) | Pine, jack | Chapleau | Small pockets of heavy infestation. |





PROVINCE OF ONTARIO

FOREST DISEASE SURVEY

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INTRODUCTION

During 1959, prolonged midsummer droughts caused extensive foliage injury to many hardwood species throughout southern Ontario.

An unusually severe outbreak of poplar ink spot disease caused by *Ciborinia whetzellii* (Seav.) Seav., resulted in extensive foliage damage to trembling aspen throughout most of northern Ontario.

Of the collections submitted during 1959, only 2,262 have been processed at writing time due to unavoidable circumstances. More than 110 requests for identification and control recommendations were answered during the year. The collections handled were distributed among the principal host trees as follows:

| Coniferous Trees | Collections | Broad-leaved Trees | Collections |
|-------------------|-------------|--------------------------|-------------|
| Balsam fir..... | 182 | Poplar..... | 329 |
| Jack pine..... | 97 | Elm..... | 288 |
| Black spruce..... | 74 | Birch..... | 228 |
| White pine..... | 72 | Alder..... | 215 |
| Red pine..... | 32 | Maple..... | 185 |
| White spruce..... | 22 | Willow..... | 114 |
| Scots pine..... | 18 | Cherry..... | 96 |
| Cedar..... | 18 | Mountain ash..... | 57 |
| Larch..... | 3 | Oak..... | 55 |
| Mugho pine..... | 2 | Ash..... | 45 |
| Hemlock..... | 2 | Hazel..... | 23 |
| Others..... | 5 | Beech..... | 19 |
| | | Basswood..... | 17 |
| | | Apple..... | 8 |
| | | Sycamore..... | 7 |
| | | Ironwood..... | 6 |
| | | Dogwood..... | 5 |
| | | Elder..... | 3 |
| | | Others..... | 7 |
| Total..... | 527 | Total..... | 1,707 |
| | | Miscellaneous hosts..... | 28 |
| | | Grand Total..... | 2,262 |

IMPORTANT DISEASES

Dutch Elm Disease—During 1959 *Ceratocystis ulmi* (Buism.) C. Moreau, the causal organism of Dutch elm disease, was isolated from 110 of 265 samples submitted for culturing.

The accompanying map shows the number of samples from each county from which the causal fungus has been isolated since the disease was first recorded in Ontario in 1946, subdivided as follows, 1946 to 1958 and 1959.

In 1959 the organism was found in Huron, Perth, Peterborough, Northumberland, Hastings, and Lanark counties for the first time.

Ink Spot Disease of Aspen Poplar—*Ciborinia whetzelii* (Seav.) Seav., the causal agent of this disease was reported from 103 townships in 18 forest districts. In some areas small trees, less than 6 feet tall, were killed. On larger trees severely infected leaves were completely killed by midsummer, but remained on the trees until fall, producing a scorched appearance.

Needle Rusts of Pine and Spruce—During 1959, collections of *Coleosporium asterum* (Diet.) Syd. were obtained from jack and red pine trees in the Lake Simcoe, Lake Erie, Lake Huron, Fort Frances, Geraldton, Parry Sound, Pembroke, Port Arthur, Sault Ste. Marie, North Bay, Chapleau, and Pembroke districts. Once again the incidence of this disease was higher than in the preceding year, with plantations in southwestern Ontario the most severely affected.

Chrysomyxa ledicola Lagerh. and *Chrysomyxa ledi* de Bary were found on collections submitted from the Port Arthur, Fort Frances, Chapleau, Sudbury, Geraldton, Gogama, North Bay, Sault Ste. Marie, Sioux Lookout, and White River districts. Disease incidence seemed to be particularly high in the Port Arthur District.

Canker and Dieback of Balsam Fir—Collections taken from trees exhibiting the symptoms of this condition again yielded one of the following fungi: *Thyronectria balsamea* (Cke. & Peck.) Seeler, *Dermea balsamea* (Peck) Seav., *Cytospora friesii* Sacc., or *Cytospora abietis* Sacc.

The incidence of this condition generally declined in all areas of the Province during 1959, with the exception of the Kapuskasing District, where many unreported pockets of affected trees were found.

Leaf and Twig Blight of Poplar—This condition was much more extensive on trembling and largetooth aspen as well as on balsam poplar during 1959. The causal organisms, *Pollacia radiosa* (Lib.) Bald. & Cif. on trembling and largetooth aspen and *Pollacia elegans* Serv. on balsam poplar, were found on collections submitted from the Sudbury, Lindsay, Port Arthur, Chapleau, Fort Frances, Kapuskasing, Gogama, Geraldton, Tweed, Parry Sound, Pembroke, North Bay, Cochrane, White River, and Kenora districts.

Septobasidium pinicola Snell—The continuing interest in the scale insects associated with this fungus, prompted further search for new locality records for this fungus in 1959. It was collected from white pine trees in Griffith, Stratton, Sproule, Canisbay, and Petawawa townships in the Pembroke District; Lyndoch, Palmerston, and Abinger townships in the Tweed District; Phelps Township in the North Bay District; and Sherbourne Township in the Lindsay District

Maple Dieback—As outlined in 1958, an intensive investigation of the so-called 'maple dieback' condition was carried out in the Southwestern Region of Ontario in co-operation with the staff of the Ontario Department of Lands and Forests. This survey indicated that the most seriously affected stands were in Grey and Bruce counties in the Lake Huron District and that partially affected maple stands occurred to the south and east of these counties.

During 1959, 70 plots were established in maple stands exhibiting 'dieback' in the Lake Huron District. About 1,250 trees were evaluated according to an injury classification ranging from normal and healthy to dead for several years. Tree species other than maple were included for comparative purposes.

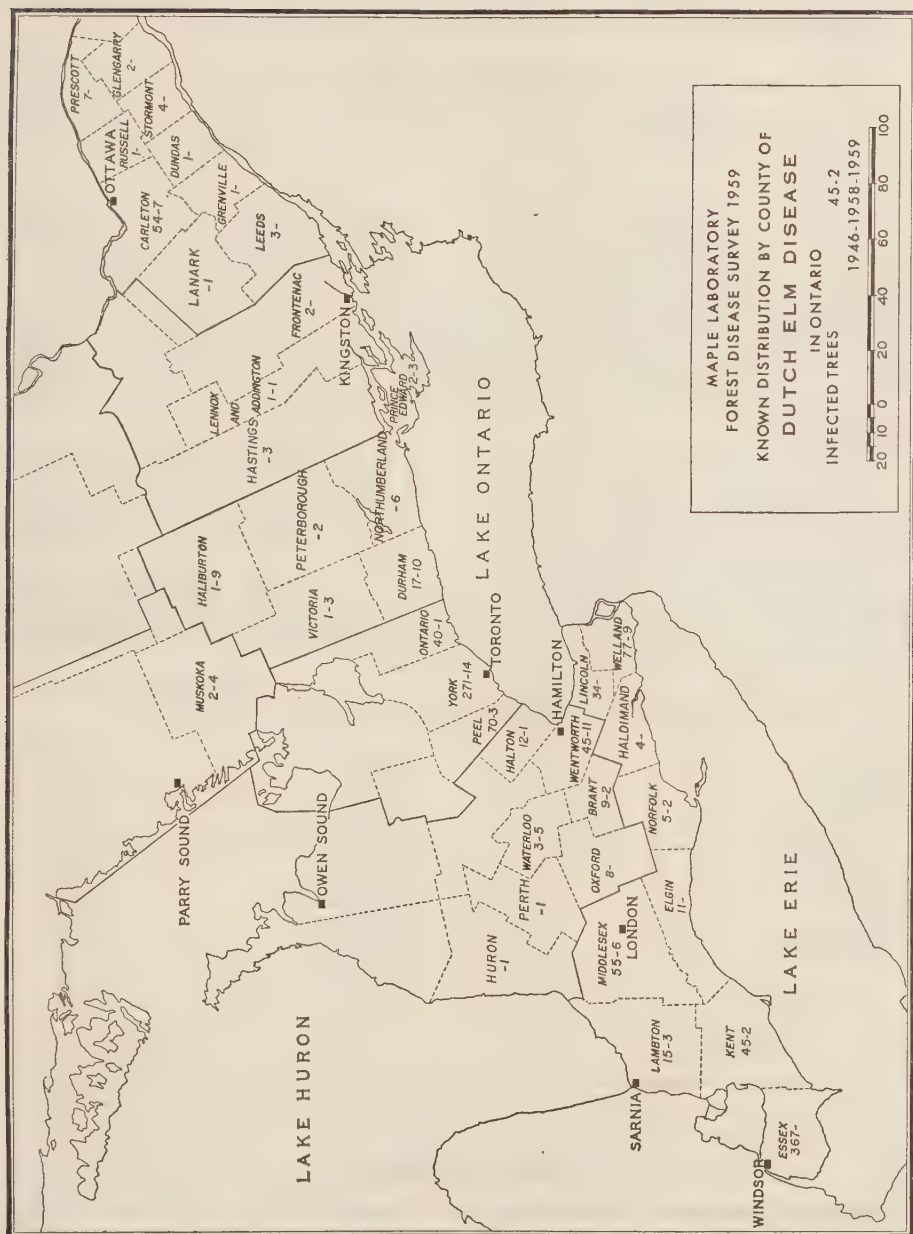
No changes in the boundaries of the affected areas have been recorded since 1958. The purpose of the study is to determine whether an increase or decrease in the intensity of the condition will occur in the plots. Future plans call for an annual re-assessment of the plots during the next four or five years.

OTHER NOTEWORTHY DISEASES

| Host | Organism | Locality | District | Remarks |
|----------------------|---|--|--|--|
| Alder | <i>Cryptospora femoralis</i> (Pk.) Sacc. | Docker Twp. | Kenora | First herbarium records. |
| | | Anglin Twp. Best Twp. Rainy Lake St. Julien Twp. | Pembroke North Bay Port Frances White River | |
| | <i>Eutypella cerviculata</i> (Fr.) Sacc. | Ware Twp. | Pt. Arthur | First herbarium records. |
| | | Matchedash Twp. Dalhousie | Lake Simcoe Tweed | |
| | <i>Fenestella princeps</i> Tul. | Antikameg Lake | White River | First herbarium record. |
| | <i>Melanconis alni</i> var. <i>marginalis</i> (Pk.) Wehm. | Zealand Twp. | Kenora | On branches, canker (?) dieback (?) |
| | | Bridges Twp. Caribou Lake Lake St. Joseph McCrea Lake Hunt Twp., Twp. 52 Twp. 52 | Kenora Sioux Lookout Sioux Lookout Sioux Lookout White River White River White River | First herbarium records. |
| | <i>Melanconis alni</i> var. <i>marginalis</i> (Peck) Wehm. | Leslie Twp. Lapierre Twp. Chapleau | White River Geraldton Chapleau | |
| | <i>Valsa oxystoma</i> Rehm | Tustin Twp. MacNichol Twp. Joan Twp. | Kenora Kenora North Bay | First herbarium records. |
| Ash, white | <i>Valsaria moroides</i> (Cke. & Peck) Sacc. | Twp. 28R XXI | Sault Ste. Marie | First herbarium record. |
| | <i>Phoma infossa</i> Ell. & Ev. | Chinguacousy Twp. Rama Twp. | Lake Simcoe Lake Simcoe | Canker and dieback(?) First herbarium host records. |
| Ash, mountain | <i>Dermea ariae</i> (Pers. ex Fr.) Tul. ex Karst. and its imperfect stage <i>Micropera sorbi</i> Sacc. | Gilles Limit, Best Twp. | North Bay North Bay | 1rst herbarium records. |
| | | Cassels Twp. Bryant Twp. Welsh Twp. Twp. 27R XXIV Twp. 30R XXV Twp. 28R XXIV | North Bay White River White River White River White River White River | |
| Ash, mountain | <i>Dermea ariae</i> (Pers. ex Fr.) Tul. ex Karst. and its imperfect stage, <i>Micropera sorbi</i> Sacc. | Red Point Lake | Kenora | |
| | <i>Diaporthe impuls</i> a (Cke. & Pk.) Sacc. | Lloyd Twp. | Gogama | First herbarium record. |
| | <i>Dothiora sorbi</i> (Wahlbg.) Rehm | Bryant Twp. | White River | First herbarium records. |
| | | Twp. 30R XXV Bastedo Twp. Gilles Limit | White River North Bay North Bay | |
| Aspen, hybrid | <i>Valsa cincta</i> Fr. | Plot No. 4, R.C. 17 Cascaden Twp., | White River Sudbury | First herbarium records. |
| | <i>Plagiostoma populi</i> Cash & Waterman | P.F.E.S., Chalk River | Pembroke | Leaf disease of hybrid poplars. First herbarium record. |
| Aspen, largetooth | <i>Valsaria exasperans</i> (Gerard) Ell. & Ev. | P.F.E.S. Chalk River | Pembroke | First herbarium record. |
| | <i>Marssonina rhabdospora</i> (Elli. & Ev.) Magn. | P.F.E.S., Chalk River | Pembroke | Leaf spot of largetoothed aspen. |
| | | Biggar Twp. Head Twp. | Pembroke Pembroke | First herbarium record. |
| Aspen, trembling | <i>Dothiora sphaeroides</i> (Pers.) Fr. | Twp. I-VI, Wells | Sault Ste. Marie | First herbarium record. |
| | <i>Valsa nivea</i> (Pers.) Fr. | P.F.E.S., Chalk River | Pembroke | Canker(?) First herbarium record. |
| Beech | <i>Asterosporium hoffmannii</i> Kunze | Sullivan Twp. | Lake Huron | First herbarium record. |
| | <i>Dialrype virescens</i> (Schw.) Rav. | Kenmiss Lake Rd. | Lindsay | First herbarium record. |

OTHER NOTEWORTHY DISEASES—Concluded

| Host | Organism | Locality | District | Remarks |
|--------------------|---|---|--|--|
| Birch, white | <i>Dermea molliuscula</i> (Schw.) Cash | Drayton Twp. | Sioux Lookout | First herbarium record. |
| | <i>Melanconis stilbostoma</i> (Fr.) Tul. | Norway Lake Rd. | Kenora | First herbarium records. |
| Birch, white | <i>Pleomassaria siparia</i> (B. & Br.) Sacc. and its imperfect stage <i>Prosthemium betulinum</i> Kunze | Expanse Lake, Prince Twp. Twp. 52 | Sioux Lookout Sault Ste. Marie White River | First herbarium records. |
| | <i>Sleganosporium muricatum</i> Bon. | Loonhaunt Lake | Ft. Frances | First herbarium records. |
| Dogwood | <i>Apioportha corni</i> Wehm. | Poohbah Lake | Ft. Frances | First herbarium records. |
| Hazel | <i>Diatrypella verrucaeformis</i> (Ehr.) Nits. | Grey Twp. Snowball | Lake Huron Lake Simcoe | First herbarium records. |
| | <i>Mamiania coryli</i> (Fr.) Ces. & DeNot. | McKim Twp. | Sudbury | First herbarium records. |
| | | Plummer Twp. Plot No. 9, R.C. 17 | Sault Ste. Marie White River | Leaf spot; First herbarium host record. |
| Ironwood | <i>Melanconis ostryae</i> (Dearn.) Wehm. | P.F.E.S. Chalk River | Pembroke | First herbarium record. |
| Locust | <i>Camarosporium robineae</i> (Westd.) Sacc. | Port Dover | Lake Erie | On dead branches. First herbarium record. |
| Maple | <i>Diatrypella frostii</i> Peck | McLean Twp. | Parry Sound | First herbarium records. |
| Maple, mountain | <i>Cryptodiaporthe densissima</i> var <i>spicata</i> (Ell. & Ev.) Wehm. | Maple Plot No. 3, R.C. 17 | Lake Simcoe White River | On dead branches. First herbarium record. |
| | <i>Hypoderma rufilabrum</i> (Berk. & Curt.) Duby | Long Lake | Kapuskasing | On dead branches. First herbarium records. |
| | <i>Prosthectium innesii</i> (Curr.) Wehm. | Butler Twp., Plot No. 6, R.C. 17 St. Louis Twp. | North Bay White River Gogama | First herbarium records. |
| Maple, red | <i>Diatrype stigma</i> (Hoff.) Fr. | Antoine Twp. | North Bay | First herbarium record. |
| | <i>Massaria inquilans</i> (Tode) de Not. | Antoine Twp. Racine Rd. | North Bay Chapleau | First herbarium records. |
| Maple, sugar | <i>Diatrype stigma</i> (Hoffm.) Fr. | Wells Twp. | Sault Ste. Marie | First herbarium records. |
| | <i>Eutypella parasitica</i> Davids. & Lorenz | Nashville | Lake Simcoe | Causing cankers on hard maple trees. First herbarium record. |
| Oak, white | <i>Colpoma quercina</i> (Pers.) Wallr. | Matchedash Twp. | Lake Simcoe | On dead branches of living trees. First herbarium record. |
| | <i>Diaporthe taleola</i> (Fr.) Sacc. | Baxter Twp. Bathurst Twp. | Lake Simcoe Tweed | First herbarium record. |
| Pine, white | <i>Microspora</i> sp. | Lake Twp. | Tweed | On blister rusted trees appears to be similar to <i>Gelatinosporium obelinum</i> Pk. First herbarium record. |
| Serviceberry | <i>Valsa ceratophora</i> Tul. | Twp. 26R XXVI | White River | First herbarium record. |
| Spruce, white | <i>Sphaeropsis ellisii</i> Sacc. | Uxbridge | Lake Simcoe | First herbarium record. |
| Sumach | <i>Cryptodiaporthe aculeans</i> (Schw.) Wehm. | Ridout Twp. | Parry Sound | Canker & dieback(?) First herbarium record. |
| Sycamore | <i>Hendersonia desmazieri</i> Mont. | Port Dover | Lake Erie | First herbarium record. |



PROVINCES OF MANITOBA AND SASKATCHEWAN

FOREST INSECT SURVEY

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INTRODUCTION

The dominant feature of forest insect conditions in 1959 was the collapse of the main spruce budworm infestations in eastern Manitoba. Surveys were directed toward assessing the losses in white spruce and balsam fir stands following three or four years of heavy attack. Surveys of larch sawfly infestations required additional attention because changes from endemic to epidemic conditions were apparent. Severe infestations were reported from parts of northern western, and eastern Manitoba, and there was a noteworthy increase in numbers of the sawfly in the long-established infestations in the Prince Albert District of Saskatchewan.

Important defoliators that showed little or no change in status from the previous year were the forest tent caterpillar, the large aspen tortrix, and the jack-pine budworm. Species not generally recognized as major forest insects but showing an increase in abundance were the balsam-fir sawfly, the yellow-headed spruce sawfly, and the spiny elm caterpillar.

The effects of severe weather conditions outlined in the 1958 Report were still apparent in eastern Manitoba. Many dead balsam fir trees were noticed where extreme conditions had prevailed and trembling aspen, which was severely injured last year, showed poor foliage production.

The number of samples received at the Laboratory totalled 3,152 and were distributed among the principal host trees as follows:

| Coniferous Trees | Collections | Broad-leaved Trees | Collections |
|--------------------------|-------------|----------------------------|-------------|
| White spruce..... | 420 | Trembling aspen..... | 835 |
| Jack pine..... | 348 | Willow..... | 319 |
| Tamarack..... | 249 | Balsam poplar..... | 146 |
| Black spruce..... | 157 | Eastern chokecherry..... | 122 |
| Balsam fir..... | 98 | Birch..... | 121 |
| Lodgepole pine..... | 13 | Speckled alder..... | 99 |
| Cedar..... | 9 | Manitoba maple..... | 80 |
| Scots pine..... | 8 | Green ash..... | 17 |
| Colorado spruce..... | 3 | White elm..... | 13 |
| | | Alternate leaf dogwood.... | 9 |
| | | Bur oak..... | 8 |
| | | Hazelnut..... | 2 |
| Total..... | 1,305 | Total..... | 1,771 |
| Miscellaneous hosts..... | | | 76 |
| Grand Total..... | | | 3,152 |

IMPORTANT INSECTS

Spruce Budworm, Choristoneura fumiferana (Clem.)—As forecast in the 1958 Report, spruce budworm numbers in the main outbreak area in eastern Manitoba showed a further decline. Larval collections were largely negative at most points east of Lake Winnipeg, where population levels were very high in 1957. Larvae were more common on the west side of the Lake, especially near

Pine Dock and on Hecla Island. Egg counts in this region were carried out at the same points listed in the 1958 Report. The counts were extremely low, except at Pine Dock, indicating that light defoliation may be expected in 1960.

The outbreak near Namew Lake in northern Manitoba and Saskatchewan extended north and east in 1959 and covered an area of about 750 square miles. Throughout this area scattered stands of white spruce with some balsam fir showed moderate to severe defoliation. Three small pockets of defoliation were reported in spruce and balsam fir stands along the Birch River, which is considerably south of the Namew Lake outbreak area. The forest authority in Saskatchewan expressed some concern over the possibility of the outbreak extending into the valuable timber stands through the Pasquia Hills Provincial Forest. Surveys were intensified in this area, but the budworm was collected in only very low numbers suggesting no appreciable change from previous years.

During aerial surveys of northern Manitoba two small local outbreaks of the budworm were mapped at Setting Lake and Red Sucker Lake. The areas involved were less than a square mile, but the outbreaks are unique in that they are the most northern ever recorded for Manitoba and are at least 200 miles removed from any presently known infestation.

Larvae were again common on white spruce trees in the southern parts of the two provinces including the Cypress Hills Provincial Forest and the Spruce Woods Forest Reserve, but defoliation was light.

Patches of dead balsam fir have been referred to in earlier reports from eastern Manitoba, where trees were severely defoliated from 1955 to 1957. During the late summer of 1959 mortality tallies were made in six half-acre plots having a high percentage of balsam fir. Tallies were also made in the Namew Lake area where white spruce is the major component of stands that were severely defoliated for nine consecutive years (1951 - 1959). The results of mortality tallies are summarized in the following table.

TREE MORTALITY FROM BUDWORM ATTACK IN TWO SEVERELY INFESTED AREAS IN MANITOBA AND SASKATCHEWAN

| Location of plots | Tree species and D.B.H. in inches | Stems per acre | Percentage living | | | Percentage dead |
|-----------------------|-----------------------------------|----------------|-------------------|-----------|----------|-----------------|
| | | | Healthy | Dead tops | New tops | |
| Eastern Manitoba..... | bF under 3 | 226 | 24 | 17 | 18 | 41 |
| | bF over 3 | 96 | 8 | 14 | 3 | 75 |
| | sW under 3 | 19 | 82 | 13 | 1 | 4 |
| | sW over 3 | 16 | 66 | 8 | 0 | 26 |
| Namew Lake..... | bF under 3 | 14 | 0 | 52 | 0 | 48 |
| | bF over 3 | 17 | 0 | 86 | 0 | 14 |
| | sW under 3 | 121 | 4 | 57 | 0 | 39 |
| | sW over 3 | 139 | 3 | 91 | 0 | 6 |

In eastern Manitoba high mortality has occurred in balsam fir trees in the larger diameter class. Many trees in the lower diameter class are showing signs of recovery. The decline of stands in this area was no doubt enhanced by the severe 'winter drying' reported in 1958. This is particularly true of white spruce, which suffered heavy mortality in two of the areas sampled. The conditions indicated in the above table are considered representative of stands having a high percentage of balsam fir over some 500 square miles in eastern Manitoba. In the Namew Lake infestation, where white spruce is the principal host tree, mortality is considerably lighter despite nine consecutive years of moderate to severe attack. The highest mortality has occurred on trees in the lower diameter classes. Dead tops are common among trees over 3 inches in diameter. As the outbreak is still in progress, there is no indication of recovery. The conditions indicated by the tallies at Namew Lake are considered representative of only the older outbreak area, about 5,500 acres.

The following table shows the occurrence of spruce budworm larvae in collections from spruce and balsam fir in various forest districts during the period of larval activity.

| District | Collections from spruce and balsam fir | Percentage of collections containing spruce budworm | |
|--------------------|--|---|------|
| | | 1958 | 1959 |
| Manitoba | | | |
| Southern..... | 76 | 44 | 8 |
| Eastern..... | 150 | 60 | 25 |
| Northern..... | 57 | 51 | 30 |
| Western..... | 120 | 42 | 10 |
| Saskatchewan | | | |
| Hudson Bay..... | 70 | 10 | 19 |
| Prince Albert..... | 44 | 4 | 0 |
| Meadow Lake..... | 59 | 0 | 0 |
| Northern..... | 27 | 0 | 4 |
| Southern..... | 72 | 26 | 8 |
| West-central..... | 0 | 18 | 0 |

Larch Sawfly, *Pristiphora erichsonii* (Htg.)—Infestation ratings for the larch sawfly in tamarack stands are shown on the accompanying map. Both ground and aerial surveys were used for rating infestations and at each location one or more of the following characteristics were recorded.

| Infestation class | Characteristics of Infestations | | |
|-------------------|---------------------------------|---|---|
| | Ground Surveys | | Aerial Surveys |
| | Estimated per cent defoliation | Proportion of shoots utilized for oviposition | |
| Light..... | trace—20 | less than .08 | Discoloration barely discernible, dark olive buff around periphery of crowns. |
| Moderate..... | 21—60 | .12—.22 | Deep olive buff over upper third of crowns and around periphery of remainder. |
| Severe..... | 61—100 | more than .28 | Buff brown discoloration through most of crown. |

The basis for this classification of infestations has been outlined by Nairn and Prentice*.

Although conditions varied between stands there was a general increase in larch sawfly throughout the southern range of tamarack. The most noteworthy increase occurred north of Lake Winnipegosis, especially in the Western and Northern districts of Manitoba where tamarack stands in an area of 1,300 square miles were completely stripped. In Saskatchewan the main infestations are still centred north of the Churchill River Basin. Severe defoliation extended west into Alberta and north into the Northwest Territories.

Egg sampling was again carried out in all permanent sample plots. Average counts by districts for 1958 and 1959 are shown in the following table.

| Forest District | Number of sample plots | Average percentage of current shoots utilized for oviposition | |
|--------------------|------------------------|---|------|
| | | 1958 | 1959 |
| Manitoba | | | |
| Southern..... | 4 | 1.7 | 2.1 |
| Eastern..... | 4 | 3.5 | 2.4 |
| Western..... | 3 | 1.6 | 0.9 |
| Northern..... | 3 | 1.5 | 8.0 |
| Saskatchewan | | | |
| Hudson Bay..... | 3 | 0.7 | 0.5 |
| Prince Albert..... | 3 | 2.3 | 3.2 |
| Northern..... | 3 | 3.6 | 0.8 |
| Meadow Lake..... | 4 | 1.9 | 2.2 |

*Nairn, L. D. and R. M. Prentice. Infestation ratings of the larch sawfly in Manitoba and Saskatchewan. *Forestry Chronicle* (in press). 1960.

The utilization of shoots for egg laying in northern Manitoba was the highest ever recorded. In northern Saskatchewan permanent sample plots are located south of the main infestation and the counts recorded were not considered representative of the entire area.

Large Aspen Tortrix, *Choristoneura conflictana* (Wlkr.)—There were no appreciable changes in infestation boundaries of this species, but defoliation was somewhat lighter.

Although conditions varied between stands, the insect was found in appreciable numbers throughout most of the aspen grove section of central and northern Saskatchewan. Complete defoliation was recorded in the Cowan Lake area, along the Waterhen River, at the northwest end of Montreal Lake, and in the extreme southeast corner of the Prince Albert District. The total area of complete defoliation was about 500 square miles. Larvae were common throughout the Riding Mountain National Park and the Duck Mountain Forest Reserve, but defoliation was generally light. Trembling aspen over approximately 350 square miles in the Porcupine Provincial Forest showed moderate defoliation.

In the Meadow Lake District of Saskatchewan this leaf roller was usually found in association with the two olethreutids, *Epinotia nisella criddleana* and *Pseudexentera improbana oregonana*. Although these species differ biologically, it is hard to distinguish the larval forms and assess the relative abundance of each in the field. Damage to aspen by this combination of species was most conspicuous south of Cold Lake along the Saskatchewan-Alberta boundary.

The following table shows the occurrence of aspen tortrix larvae in collections from trembling aspen during the period of larval activity.

| Districts | Collections from trembling aspen | Percentage containing large aspen tortrix | |
|--------------------|-------------------------------------|--|------|
| | | 1958 | 1959 |
| Manitoba | | | |
| Southern..... | 108 | 9 | 13 |
| Eastern..... | 79 | 33 | 15 |
| Northern..... | 42 | 24 | 14 |
| Western..... | 85 | 42 | 55 |
| Saskatchewan | | | |
| Hudson Bay..... | 83 | 59 | 53 |
| Prince Albert..... | 137 | 38 | 11 |
| Meadow Lake..... | 101 | 33 | 7 |
| Northern..... | 36 | 52 | 17 |
| Southern..... | 112 | 33 | 9 |
| West-central..... | 52 | 95 | 46 |

Jack-pine Budworm, *Choristoneura pinus* Free.—For the second year this species was found only in low numbers. Light defoliation was reported from Whitemouth Lake in the Sandilands Forest Reserve and in some Scots pine plantings in the Spruce Woods Forest Reserve. In Saskatchewan collections were limited to the Fort a la Corne and Nisbet provincial forests where defoliation was very light.

The following table shows the frequency of budworm larvae in collections from pine during the period of larval feeding in 1958 and 1959.

| Districts | Collections from jack-, lodgepole-, and Scots pine | Percentage of collections containing jack-pine budworm | |
|--------------------|--|--|------|
| | | 1958 | 1959 |
| Manitoba | | | |
| Southern..... | 78 | 47 | 36 |
| Eastern..... | 104 | 30 | 15 |
| Northern..... | 21 | 0 | 0 |
| Western..... | 22 | 0 | 5 |
| Saskatchewan | | | |
| Hudson Bay..... | 17 | 0 | 0 |
| Prince Albert..... | 64 | 11 | 4 |
| Meadow Lake..... | 35 | 0 | 0 |
| Northern..... | 14 | 0 | 0 |
| Southern..... | 14 | 4 | 7 |
| West-central..... | 0 | 0 | 0 |

White Grubs, *Phyllophaga* spp., *Serica intermixta* Blatch.—As outlined in earlier reports, white grubs have caused serious losses of pine transplants in the Agassiz Forest Reserve. At least three species are known to occur in this area, they are *Phyllophaga nitida* (Lec.), *Phyllophaga drakei* Kby., and *Serica intermixta* Blatch. The biology and taxonomy, particularly of the immature forms, of these species is not fully known but it is suspected that each has a three-year life cycle. For the past three years sampling has been designed to determine if there are major and minor flight years. The following table summarizes the results of soil samples taken during the latter part of August from 1957 to 1959.

| Year | No. of samples | Average no. of grubs per sq. ft. | Per cent adults |
|-----------|----------------|----------------------------------|-----------------|
| 1957..... | 160 | 1.4 | 66 |
| 1958..... | 80 | 3.3 | 13 |
| 1959..... | 20 | 1.6 | 10 |

These results suggest striking annual fluctuations in the grub populations. The adult population recorded in the fall of 1957 emerged in the spring of 1958, which was apparently a major flight year. The high grub count in 1958 consisted mainly of small first year larvae, the progeny of the spring adults. If it can be assumed that the third-year larvae cause the most feeding damage, 1960 would be a poor year for planting. The next major flight year may be expected in 1961.

Studies are being conducted in co-operation with the Manitoba Forest Service to determine if removing the sod layer prior to planting will reduce grub populations and subsequent losses. In 1959 grub counts in plots with the sod layer removed the previous year were 0.3 per square foot as opposed to 1.6 under natural conditions.

Root Weevils, *Hylobius warreni* Wood and *Hylobius pinicola* (Couper)—Surveys to determine the incidence of damage to root collars and roots of white spruce have been conducted for the past four years using the technique developed by Warren*. It is realized that this gives only a rough indication of cumulative

*Warren, G. L. The effect of Some Site Factors on the Abundance of *Hypomolyx piceus* (Coleoptera: Curculionidae). Ecology 37: 132-139. 1956.

damage by weevils, but it is impractical to sample current populations because of the subterranean feeding sites of these insects. Three classes of damage index have been accepted for Manitoba and Saskatchewan and these are 0 to 2, 3 to 5, and 6 to 8. These classes express a range from no damage to three-quarters of the roots and root collar girdled by larval tunnels. Collections and rearings from various areas in Manitoba and Saskatchewan indicate that at least 95 per cent of the damage is caused by *H. warreni*. Indices for areas sampled in 1959 are shown on the accompanying map. Despite the high indices for some areas, surveys have failed to reveal any white spruce stands with appreciable mortality attributable to these weevils.

Cottony Maple Scale, *Pulvinaria innumerabilis* (Rathv.)—Manitoba maple in the Greater Winnipeg area was heavily attacked by this scale in 1958. The trees were examined in the spring of 1959 to see if the infestation would recur. Counts of living and dead female scales on the outer four inches of 1957 and 1958 shoots showed that winter survival at some points was as high as 59 per cent. Because of the high survival the infestation was expected to continue in 1959. However, examination of the scales in late July revealed that 82 per cent had been attacked by the dipterous predator *Leucopomyia pulvinariae* Mall. There was no apparent damage to maple foliage during the summer and living scales could not be found on twigs or branches by late summer, indicating the predator had substantially reduced scale populations. This insect was not found in any appreciable numbers outside of the Greater Winnipeg area.

Fall Cankerworm, *Alsophila pomataria* (Harr.)—Severe defoliation of Manitoba maples was restricted to shelterbelts in the Swift Current–Success area of southern Saskatchewan. Elsewhere in this Province defoliation was generally light. In Manitoba, numbers showed a further decline. Light to moderate defoliation of Manitoba maple was recorded in the park area at Virden, but infestations previously reported in Dauphin and Swan River, completely subsided.

A Lodgepole Needle Miner, *Recurvaria* sp.—A needle miner was collected in most lodgepole pine stands in the Cypress Hills Provincial Forest. At some points as high as 10 per cent of the needles were infested. Material is being reared in order to obtain adults for positive identification.

Pine Tortoise Scale, *Toumeyella numismaticum* (P. & M.)—There was no appreciable change in the status of this insect. It was common in collections from young jack pines in the Sandilands Forest Reserve and in the Rosenberg area in Manitoba.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.—Forest tent caterpillars were common in all forest districts of Saskatchewan and in the Western District of Manitoba, but as forecast in 1958 severe defoliation was restricted to the East and Central blocks of the Cypress Hills Provincial Forest. In the park area of the Cypress Hills wandering larvae were particularly annoying to campers and tourists and a chemical control program is being considered by park authorities if the infestation continues in 1960. Outside of the Cypress Hills the heaviest concentrations of larvae appeared to be in the Prince Albert District, where the insect was usually found in association with the large aspen tortrix.

Egg surveys were again conducted in all forest districts where larvae were common. The results of sampling and forecasts on the severity of defoliation are shown in the following synopsis:

| Region | No. of sampling stations | No. of stations at which egg bands were recorded | Av. no. of egg bands per tree* | Defoliation forecast |
|-----------------------------|--------------------------|--|--------------------------------|----------------------|
| Manitoba | | | | |
| Western District..... | 10 | 1 | 1.3 | light |
| Saskatchewan | | | | |
| Cypress Hills P.F..... | 13 | 12 | 26.4 | severe |
| Prince Albert N.P..... | 4 | 1 | 0.3 | light |
| Prince Albert District..... | 15 | 3 | 3.0 | light |
| West-central District..... | 6 | 1 | 0.2 | light |
| Northern District..... | 3 | 0 | 0.0 | nil |
| Meadow Lake District..... | 21 | 5 | 0.5 | light |

*Based on examination of 3 co-dominant trees at each sample station.

Boxelder Twig Borer, *Proteoteras willingana* (Kft.)—The larvae of this insect bore into current twigs which usually die, causing considerable pruning of the ends of branches the following spring. In 1955, this borer was found in high numbers on Manitoba maple in shelterbelts. In 1956, 25 sample stations were established in southern Manitoba and Saskatchewan to follow annual changes in abundance. At each station 12 branches from sample trees are examined and the number of infested twigs recorded. The following table summarizes counts for the past four years.

| Forest District | Average percentage of twigs infested | | | |
|-------------------|--------------------------------------|------|------|------|
| | 1956 | 1957 | 1958 | 1959 |
| Manitoba | | | | |
| Southern..... | 13 | 8 | 3 | 3 |
| Saskatchewan | | | | |
| Southern..... | 24 | 15 | 4 | 3 |
| West-central..... | 10 | 14 | 4 | 4 |
| Meadow Lake..... | — | 2 | 1 | 3 |

The records show a gradual decline in twig borer numbers since 1956. The heaviest concentrations have occurred in the Southern and West-central districts of Saskatchewan. However, even here the twig borer has not been a serious pest of shelterbelts over the past four years.

Pine Root Collar Weevil, *Hylobius radicis* Buch.—For the past two years sampling for this weevil has been concentrated within a four mile radius of the old infestation in the Sandilands Forest Reserve, in southeastern Manitoba. In 1957, these plantings did not show external damage or mortality that could be attributed to *Hylobius* attack. However, it is likely that some of the root systems were infested, because retallies in 1959 showed rather high mortality as indicated in the following tabulation.

| Tree species | No. of plantations examined | No. infested | Percentage of trees | | | |
|-----------------|-----------------------------|--------------|-----------------------|-----|-------------------|-----|
| | | | Infested ¹ | | Dead ² | |
| | | | Rge. | Av. | Rge. | Av. |
| Scots pine..... | 5 | 5 | 28-100 | 60 | 12-54 | 25 |
| Red pine..... | 2 | 1 | 0-5 | 3 | 0 | 0 |

¹Based on examination of 25 root collars.

²Based on a line tally of 100 trees.

All Scots pine plantings near the older infested trees are now under attack and an average of 25 per cent mortality has occurred over the past two years. Red pine plantings are still relatively free from attack.

Pine Needle Scale, *Phenacaspis pinifoliae* (Fitch)—This insect was again the principal pest of ornamental spruce in parks and shelterbelts in southern Manitoba and Saskatchewan. It was usually found in association with the spruce spider mite, *Oligonychus ununguis* (Jac.). Discoloration of spruce foliage appeared to be less conspicuous than in 1958. This was particularly true in the Greater Winnipeg area where counts indicated a 50 per cent reduction in the number of female scales on white spruce. The reduction is based on the premise that 70 per cent of the female scales emerging in 1959 became established on the current growth.

Yellow-headed Spruce Sawfly, *Pikonema alaskensis* (Roh.)—There were no significant changes in the numbers or occurrence of this sawfly in shelterbelt areas. Light to moderate defoliation of white spruce was again reported in the Kenosee Lake and Goodeve areas. There was, however, a twofold increase in the number of collections from forested areas and 80 per cent of these were from black spruce. Fifty to 100 per cent defoliation of the current growth on black spruce was recorded on islands in René, Hatchet, Fond du Lac, and Wollaston lakes in the Northern District. At Wollaston Lake many trees have died following three years of heavy attack.

Balsam-fir Sawfly, *Neodiprion abietis* complex—A general increase in the prevalence of this complex was evident in all forest districts of Manitoba and the Hudson Bay District of Saskatchewan. It was found in high numbers together with the spruce budworm at points along the Birch River. Up to 50 per cent defoliation of the old foliage on black spruce and balsam fir was noticed in eastern and southern Manitoba at Island Lake, Nelson River, Hecla Island, Moose Lake, and East Braintree.

Spiny Elm Caterpillar, *Nymphalis antiopa* L.—Up to 90 per cent defoliation of small trembling aspen and willow trees was evident at a number of points in the Southern District of Manitoba. During late August and early September large moth flights were observed.

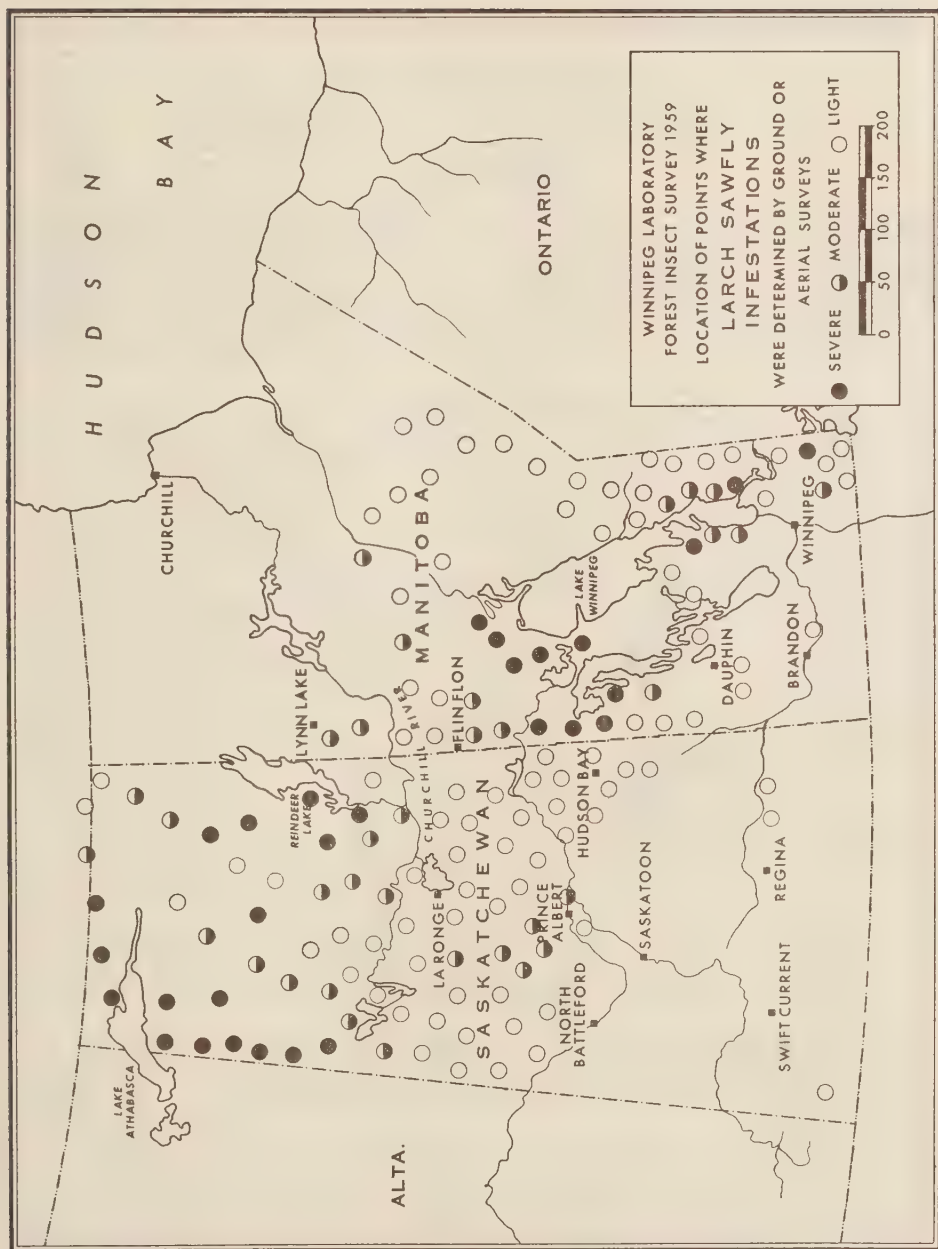
White-pine Weevil, *Pissodes strobi* (Peck)—Reports of damage to leaders of jack pine, white spruce, and black spruce were again received from all forest districts, but there were no noteworthy changes in the incidence of attack by this weevil.

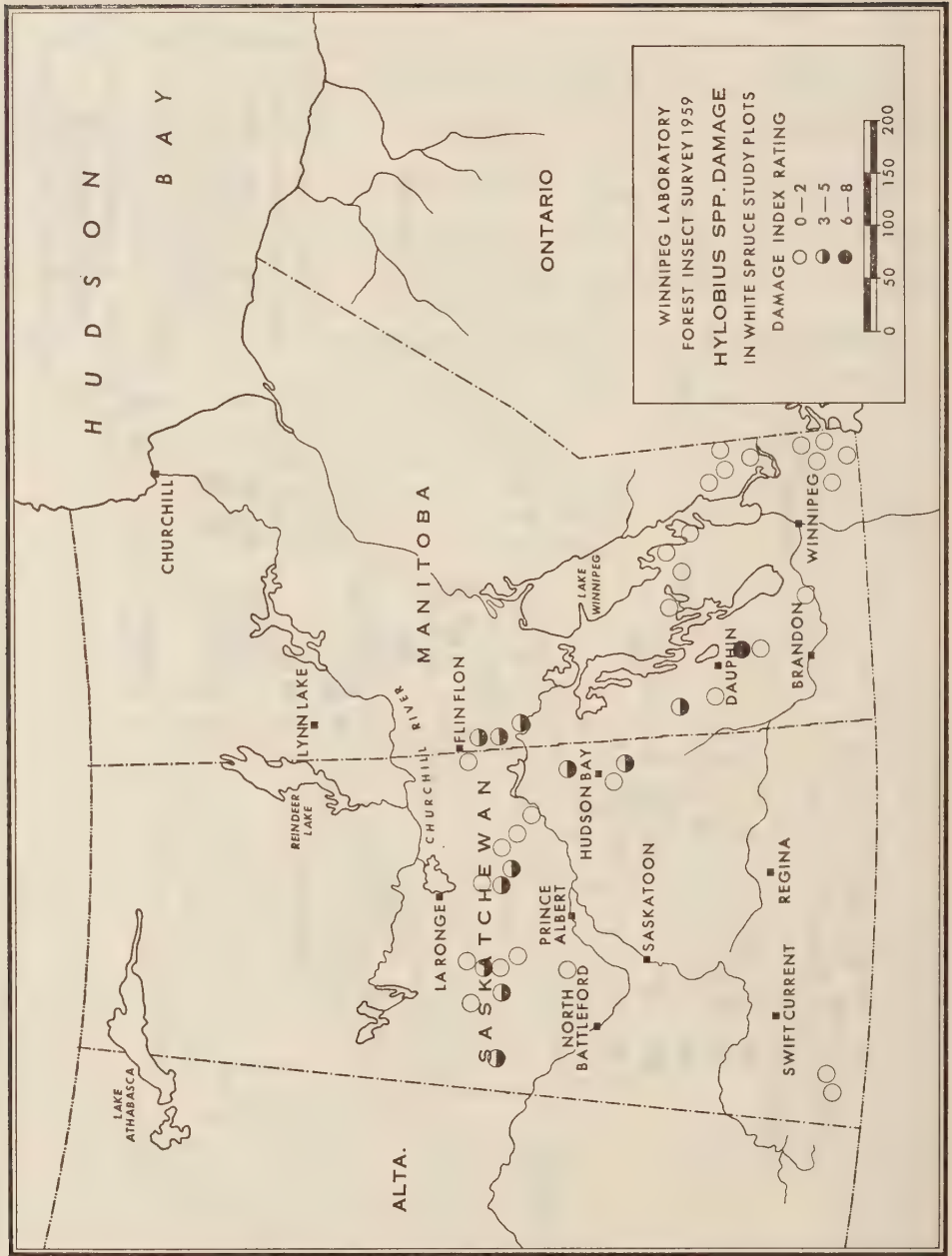
Although adults reared from jack pine are morphologically indistinguishable from *P. strobi*, J. Drouin has established that the life history and habits of 'strains' found in the Prince Albert District differ from those usually found on white pine. The cytology of the Prince Albert 'strains' and other species of *Pissodes* is being studied by Dr. S. G. Smith, of the Sault Ste. Marie Laboratory.

Larch Shoot Moth, *Argyresthia laricella* Kft.—Collections of this shoot moth from the Eastern District in 1959 constitute the first records for Manitoba. On the trees examined less than 1 per cent of the shoots were infested.

OTHER NOTEWORTHY INSECTS

| Insect | Host | Locality | Remarks |
|---|-----------------|---|---|
| <i>Chrysomela</i> spp. | Trembling Aspen | Western and Hudson Bay districts | Moderate to severe skeletonizing of young aspen in some areas. |
| <i>Compsolechia niveopulvella</i> Cham. | Trembling Aspen | Hudson Bay district | Found in high numbers for the first time. Up to 50 per cent of the leaves curled. |
| <i>Pineus strobi</i> Htg. | White pine | Southeastern Manitoba | Causing damage to current growth on native white pine. |
| <i>Pleroneura borealis</i> Felt. | Balsam fir | Local areas in the Prince Albert and Northern districts | Extensive damage to new shoots on young balsam fir. |
| <i>Pontania</i> sp. | Balsam poplar | Bar Lake and southern sections of the Prince Albert District in Sask. | Infestations caused severe curling of leaves. |
| <i>Saperda cakarata</i> Say | Trembling Aspen | Prince Albert, Northern and Meadow Lake districts | Up to 80 per cent of small aspen on poor sites attacked. |





PROVINCES OF MANITOBA AND SASKATCHEWAN

FOREST DISEASE SURVEY

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INTRODUCTION

In 1959, the Forest Disease Survey featured special projects and general collecting of common and new diseases. Special projects were concerned with *Polyporus tomentosus* (Fr.) root and butt decay, *Flammula alnicola* (Fr.) Quél. root and butt decay, jack pine mistletoe, and possible alternate hosts of rusts of jack pine. Forest diseases not previously reported included *Melanconium* leaf blight of poplar and leaf rust of *Melampyrum*.

IMPORTANT DISEASES

Root and Butt Rot of Conifers—A survey for root rot in stands of white and black spruce was continued. Stands 60 to 100 years of age were sampled systematically at one or more stations in all ranger districts. In Saskatchewan sampled stands were located at Cypress Hills, Meadow Lake, Waskesiu Lake, Prince Albert, Candle Lake, and Hudson Bay, and in Manitoba at Riding Mountain, Duck Mountain, Porcupine Hills, and in eastern and southeastern Manitoba. In the 33 stands now sampled, *Polyporus tomentosus* and *Armillaria mellea* (Vahl ex Fr.) Quél. were commonly associated with roots rots. This supports the belief that these diseases are generally distributed.

Root and butt rot of white spruce caused by *Flammula alnicola* has been reported only once in Saskatchewan (Doré Lake) and once in Manitoba (Duck Mountain Forest Reserve). This year a sporophore was collected in the region for the first time near Cowan Lake, Saskatchewan. At Candle Lake, where extensive sampling has been in progress for several years, the decay was collected for the first time. This decay was also found in the Doré Lake region.

Armillaria root rot was collected on jack pine near Prince Albert and Candle Lake, Saskatchewan, and on jack pine and red pine in southeastern Manitoba. A few Armillaria root rot samples were collected on Scots pine in the Bronson Provincial Forest, Saskatchewan.

Trunk Decay—*Fomes pini* (Fr.) Karst. trunk decay was collected from planted European larch at Indian Head, on white spruce in various parts of Saskatchewan, and on tamarack and jack pine in eastern Manitoba.

Jack-pine Mistletoe—A large stand of jack pine severely infected with mistletoe was observed near the south shore of Lake Athabaska about 58° 40' north. This extends the known distribution of mistletoe almost to the northern limits of jack pine.

Leaf Blight of Aspen—*Melanconium* sp. associated with a leaf blight on aspen was collected in eastern and southern Manitoba. It was also very conspicuous between Saskatoon, Waskesiu, and Hudson Bay, Saskatchewan. Severe browning of foliage occurred during early June and as the season progressed small black fruiting bodies appeared in circular patches on dead and living tissue. This is believed to be the first record of *Melanconium* leaf blight in Manitoba and Saskatchewan.

Marssonina leaf blight caused severe damage to aspen foliage near Montreal Lake, especially in stands at Bigstone and Skunk Creek.

Leaf Spots—Ink spots of aspen (*Ciborinia whetzellii* (Seav.) Seav.) and Septoria leaf spot of black poplar occurred in isolated areas of Manitoba and Saskatchewan. Leaf spots were not as important as Melanconium leaf blight. The only known occurrence of severe ink spot damage on aspen was in the Interlake region of Manitoba.

Chrysomyxa Needle Rust of Spruce—With few exceptions, very little needle rust of spruce was reported. General distribution of needle rust was reported in immature white spruce stands in the Interlake region of Manitoba. Spruce needle rust was very conspicuous on black spruce along No. 10 Highway from Prospector to Baker's Narrows, Manitoba.

Low Temperature—In northern Saskatchewan, early spring frosts caused light damage to many broadleaf trees. Moderate frost damage to young shoots occurred in a mixed plantation of jack pine and Scots pine in the Fort à la Corne Provincial Forest of Saskatchewan.

Some winter browning of balsam fir occurred in northern Manitoba. Jack pine in the Lake Athabaska area, and white spruce along the roadsides in the Montreal Lake-Waskesiu area suffered moderate damage from winter drying.

Leaf Rust of Melampyrum—Very light aecial infection of *Melampyrum lineare* Desr. was first observed in late June and early July near Prince Albert and Candle Lake, Saskatchewan. Secondary infection reached epidemic proportions in late August and early September. Both telia and uredia were produced but uredia were very few compared to a very large number of telia per leaf. Melampyrum rust is of interest because it is possibly the alternate stage of globose rust on jack pine.

Cankers of Poplar and Deterioration of Poplar Stooling Stock—Many diseased poplar transplants were examined at Indian Head in 1959. Cankers were very numerous on branches and main stems. Poplar transplants may be predisposed to cankering by injury from drought or winter drying. Three fungi, *Cytospora*, *Septoria*, and an unknown imperfect, were associated with these cankers.

Poplar stooling stock has suffered severely from dieback that is at least partly associated with insect injury. *Cytospora* was frequently present.

Herbicide Injury of Manitoba Maple—Manitoba maples in a nursery at Estevan, Saskatchewan were deformed by a growth stimulation of the terminal portion of the branches. Buds which should not have produced shoots until next year developed and produced short shoots with small leaves bunched into clusters. The leaves were uniformly green, veins were not distorted, and there was no mottling of leaf surface. The terminal parts of the shoots, were succulent and without taper. Several thousand young nursery trees were affected. Similar symptoms have been observed commonly throughout the prairie region for some years, and the condition ascribed to 2, 4-D herbicide.

Pleurotus tessulatus on Manitoba Maple—Several specimens of *Pleurotus tessulatus* (Bull. ex Fr.) Gillet were collected on Manitoba maple trees at Indian Head, Kenworth, and Saskatoon. This fungus has been reported previously as *P. ulmarius* (Bull. ex Fr.) Quél. (on elm, Saskatoon, 1951). It also occurs in the Winnipeg area on living or dead Manitoba maple and American elm trees.

Mushrooms and Boletes—Early in the fall, mushrooms and boletes were conspicuously abundant in association with jack pine, tamarack, and spruce. This coincided with the timely fall rains and prolonged cold weather.

PROVINCE OF ALBERTA

FOREST INSECT SURVEY

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INTRODUCTION

Insects caused little damage to spruce and pine trees in Alberta and the National Parks in 1959. In the Northwest Territories, damage by the spruce budworm decreased along the Mackenzie River but increased along the Slave and Liard rivers. Deciduous trees in many parts of the Province were severely defoliated. The larch sawfly caused severe defoliation in the northeastern quarter of the Province and between the Northwest Territories boundary and the south shore of Great Slave Lake. The forest tent caterpillar caused severe defoliation of trembling aspen in the Lac La Biche and Grande Prairie Forest Biology Ranger districts. The Bruce spanworm and several species of leaf rollers caused defoliation along the eastern slopes of the Rocky Mountains and throughout the aspen grove section. Infestations of the aspen leaf miner increased in distribution and intensity, and a scale insect infestation on poplar was reported from north-central Alberta.

Aerial survey time was increased in 1959 and infestations of poplar feeding insects were surveyed from the air for the first time. Aerial surveys were also used to determine the status of the larch sawfly and the spruce budworm infestations. Twenty hours of flying time were provided by the Department of Northern Affairs and National Resources for aerial surveys of the spruce budworm infestations in the Northwest Territories.

Investigations of the life history and morphology of the Adelginae and of the dispersal of the Bruce spanworm were continued. Investigations of the life history and seasonal development of the spruce budworm at Fort Norman, Northwest Territories was begun in 1959.

Unusually wet weather in August and increased emphasis on special projects and aerial surveys resulted in fewer collections in 1959 than in 1958; 1,650 collections were received. The assistance and co-operation of provincial, federal, and industrial personnel is gratefully acknowledged. The number of collections from the principal tree hosts were:

| Coniferous Trees | Collections | Broad-leaved Trees | Collections |
|------------------|-------------|--------------------------|-------------|
| Spruce..... | 341 | Trembling aspen..... | 547 |
| Pine..... | 162 | Willow..... | 114 |
| Larch..... | 142 | Poplar..... | 69 |
| Fir..... | 26 | Manitoba maple..... | 67 |
| Douglas fir..... | 21 | Birch..... | 26 |
| | | Ash..... | 10 |
| | | Elm..... | 4 |
| Total..... | 692 | Total..... | 837 |
| | | Miscellaneous hosts..... | 121 |
| | | Grand Total..... | 1,650 |

IMPORTANT INSECTS

Larch Sawfly, *Pristiphora erichsonii* (Htg.)—The area infested by the larch sawfly in 1959 was more extensive than in 1958. Aerial surveys in the north-western corner of the Province revealed that the larch sawfly was present as far west as the Hay Lakes. In the Northwest Territories it occurred as far north as Great Slave Lake and the infested area extended westward from the Precambrian Shield to the Mackenzie Highway. Elsewhere there was little change in the distribution of this insect. Although tamarack grows throughout most of the Mackenzie River Basin, larch sawflies were rare or non-existent except south of Great Slave Lake.

For the past four years the centre of heavy defoliation has gradually been moving west and north. The heavy defoliation reported from near Edmonton last year has diminished to a few small patches. West of Highway 2 heavy defoliation was reported between Sundre and Alder Flats, in a narrow band east and north of Highway 44 from Fawcett to within 8 miles of Slave Lake. As in 1958 the largest area of heavy defoliation occurred in the northeastern part of the Province and the adjacent Northwest Territories. Heavy defoliation was reported along the Saskatchewan Border from the Clearwater River north to the Northwest Territories Boundary, then northwest to the mouth of the Slave River. From Lesser Slave Lake north to Buffalo Lake in the Northwest Territories heavy, moderate, and light infestations were reported. Moderate to heavy infestations predominated in the Fort Vermilion and Buffalo Lake areas. Heavy defoliation extended from Buffalo Lake to the south shore of Great Slave Lake. The northwestern boundary of this heavy infestation was 10 to 50 miles farther west in 1959 than in 1958. The interior of this area was not surveyed in 1959.

Tamarack stands along the Mackenzie Highway from Grimshaw to High Level were affected by a climatic injury which resulted in very short needles. From the air these could not be easily distinguished from severely defoliated trees and may have introduced some error into the defoliation estimates for that area.

Moderate defoliation was present in the Fort McMurray–Cold Lake–Edmonton–Calling Lake area and in patches of varying size in the area bounded by Stettler, Edmonton, Whitecourt, Edson and Nordegg. Light defoliation was recorded in most of the remainder of the tamarack stands in Alberta. The infestation on the Kananaskis Forest Experiment Station was reduced in 1959 and only light damage was observed.

The results of sequential sampling in the following table indicate the infestation classes at sampling stations in 1958 and 1959. Repeated heavy defoliation has reduced the number of new twigs produced and may have biased the sampling in some areas.

| Location | Infestation Class | | Location | Infestation Class | |
|---------------------|-------------------|----------|-----------------------|-------------------|----------|
| | 1958 | 1959 | | 1958 | 1959 |
| High Level..... | light | nil | Spedden..... | moderate | nil |
| Keg River..... | nil | nil | Barrhead..... | severe | severe |
| Clear Prairie..... | moderate | light | Obed..... | nil | nil |
| Grimshaw..... | nil | light | Gainford..... | moderate | light |
| Watino..... | severe | moderate | Edmonton..... | severe | moderate |
| Grouard..... | light | light | Peers Turnoff..... | nil | light |
| Slave Lake..... | moderate | light | Muskeg River..... | nil | nil |
| Calling Lake..... | moderate | moderate | Mercoal..... | nil | light |
| Grande Prairie..... | light | light | Millet..... | moderate | light |
| Lac La Biche..... | moderate | light | Winfield..... | moderate | light |
| Flatbush..... | moderate | moderate | Nordegg..... | light | light |
| Cold Lake..... | light | light | Rocky Mtn. House..... | light | severe |
| Josegun Lake..... | light | nil | Clearwater..... | moderate | moderate |
| Perryvale..... | light | severe | Caroline..... | light | moderate |
| Whitecourt..... | severe | moderate | | | |

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.—Two large and several small areas of aspen were defoliated by the forest tent caterpillar in 1959. The large areas were near Elk Point where severe defoliation has occurred for the past three years, and in the Wapiti-Sturgeon Lake area southeast of Grande Prairie where severe defoliation was first reported in 1959. The area near Elk Point was approximately 600 square miles and was bounded by Hoselaw, St. Edward, Morecambe, Chailey, Gratz, and Elk Point. The area southeast of Grande Prairie was approximately 1,450 square miles. Small patches of heavy defoliation were reported west of Woking, south of Nampa, south of Donnelly, south of Fawcett Lake, north of Lyle Lake, and between Marie and Cold lakes.

Moderate defoliation occurred near Goodwin, Northmark and Smith. Light defoliation was almost continuous from the Saskatchewan border between Lloydminster and Cold Lake to Calling Lake and Nestow. Patches of light infestation were scattered throughout the Peace River Block. The forest tent caterpillar caused some damage to shade and shelterbelt trees in the City of Lethbridge and the surrounding area but defoliation was less serious than in previous years because of the spraying programs in 1957, 1958, and 1959. The infestation in the Alberta section of the Cypress Hills was lighter than in 1958 and little damage was observed.

Sequential sampling* of forest tent caterpillar egg bands in the fall of 1959 gave the following results.

| Location | Predicted defoliation 1960 | Location | Predicted defoliation 1960 | Location | Predicted defoliation 1960 |
|---------------------|----------------------------------|----------------------|----------------------------------|-------------------|----------------------------------|
| Whitelaw..... | noticeable | Two Hills..... | not noticeable | Fawcett Lake..... | noticeable |
| Peace River..... | noticeable | Andrew..... | not noticeable | Hualien..... | not noticeable |
| Dixonville..... | not noticeable | Stry..... | nil | Demmitt..... | nil |
| Manning..... | not noticeable | Warspite..... | not noticeable | Baytree..... | nil |
| McLennan..... | nil | Vilna..... | nil | Spirit River..... | nil |
| Lac La Biche..... | not noticeable | Brierville..... | noticeable | Tangent..... | not noticeable |
| Grassland..... | nil | Wandering River..... | noticeable | Grovedale..... | noticeable |
| Calling Lake..... | not noticeable | Beauvallon..... | noticeable | Edmonton..... | nil |
| Athabasca..... | not noticeable | Cold Lake..... | noticeable | Provost..... | not noticeable |
| Rochester..... | noticeable | Bonnyville..... | noticeable | Vermilion..... | noticeable |
| Ashmont..... | not noticeable | Ellscoth..... | not noticeable | Rivercourse..... | not noticeable |
| Elk Point (N.)..... | noticeable | Debolt..... | not noticeable | Fabyan..... | nil |
| Elk Point (S.)..... | noticeable | Sturgeon Lake..... | noticeable | Ribstone..... | nil |
| Dewberry..... | noticeable | High Prairie..... | nil | Hughenden..... | nil |
| Vermilion..... | noticeable | Driftpile..... | not noticeable | Loughheed..... | nil |
| Mannville..... | noticeable | Slave Lake..... | nil | Phillips..... | nil |

Spruce Budworm, *Choristoneura fumiferana* (Clem.)—Spruce budworm infestations declined along the Mackenzie River but increased along the Liard and Slave rivers in 1959. Budworms could be found in most of the stands along the Mackenzie River but defoliation was so light that it could not be seen from the air. Only light infestations were evident along the Mackenzie River from Fort Simpson to Fort Norman except at Camsel Bend, 10 miles south of Wrigley, and near Fort Simpson where defoliation was classed as moderate. Along the Liard River the budworm caused light to medium defoliation for 10 miles from the junction with the Mackenzie River. Medium defoliation was observed further upstream for 20 miles below the mouth of the South Nahanni River. Medium to heavy defoliation was also reported from Fort Liard to within 6 miles of the British Columbia boundary. This area of medium to heavy defoliation extended for 15 miles up the Petiot River and for 18 miles up the Katenellee River. There was light defoliation along the remainder of the Katenellee River.

The spruce budworm infestation along the Slave River extended from 10 miles north of the Salt River to 15 miles north of Long Island, a distance of

*Connola, D. P., W. E. Waters, and W. E. Smith. The development and application of a sequential sampling plan for forest tent caterpillar in New York. N.Y. State Mus. and Sci. Serv. Bull. 366, 1957.

approximately 90 miles. The degree of defoliation varied from light to moderate in the southern half and from moderate to heavy in the northern half of the infested area.

In the Cypress Hills, the infestation in the Battle and Grayburn creeks area remained the same size as last year but defoliation was less severe with only medium damage to the current year's growth. Approximately 40 per cent of the larvae collected were the spruce coneworm, *Dioryctria reniculella* (Grote).

The two-year-cycle spruce budworms in the National Parks were in the first year of development in 1959 and caused little damage. Moderate defoliation of the new growth can be expected in some areas of Yoho National Park in 1960.

Leaf Rollers on Aspen—The complex of species reported in 1958 continued to cause leaf roller damage in 1959. Of this complex approximately 92 per cent of the larvae collected were *Pseudexentera improbana oregonana* Wlsh.; 6 per cent *Choristoneura conflictana* (Wlk.); and 2 per cent *Compsolechia niveopulvella* (Cham.). *P. improbana oregonana* remained the most injurious leaf roller, *C. conflictana* was slightly more numerous than last year and *C. niveopulvella* was no longer an important insect.

As in 1958, leaf rollers could be found in almost every aspen stand in the Province. Complete defoliation occurred in patches within a radius of 100 miles from Edmonton. Moderate to severe defoliation occurred in the Woking, Sexsmith and Clear Prairie areas. Patches of light to moderate defoliation were reported in the aspen zone from Edmonton east to the Saskatchewan boundary. Rolled leaves and patches of light defoliation were present throughout the remainder of the aspen zone.

Bruce Spanworm, *Operophtera bruceata* (Hulst)—Larvae of this insect caused considerable defoliation of aspen trees along the foothills from the Porcupine Hills to Rocky Mountain House and east through the aspen grove region to the Saskatchewan border. Numbers decreased south of the Bow River Valley and increased north of the Valley. A westward shift of outbreak conditions was also evident. West of Edmonton, in the Hinton, Obed and Marlboro areas where heavy defoliation occurred in 1958 only light defoliation was evident. In northwestern Alberta moderate to heavy defoliation occurred around Woking, west of Grande Prairie, and between Spirit River and the British Columbia boundary. The heavy infestation reported from the Clear Hills in 1958 subsided.

Douglas-fir Bark Beetle, *Dendroctonus pseudotsugae* Hopk.—A small outbreak of the Douglas-fir bark beetle, was reported from the Porcupine Hills in 1959. The outbreak occurred in a small stand of mature Douglas firs adjacent to a logged-over area. In the fall of 1959, a strip cruise of the area, based on information on volumes obtained from the Alberta Forest Service showed the volume of timber destroyed by the bark beetles to be 124,500 fbm or 10 per cent of the total volume. Ninety-four per cent of the trees had been attacked within the last three years.

Yellow-headed Spruce Sawfly, *Pikonema alaskensis* (Roh.)—Infestations of the yellow-headed spruce sawfly were less intense in 1959 than in 1958. Numbers were markedly reduced in the Peace River Block and around Edmonton. Medium to heavy infestations were reported from the Penhold-Stettler-Camrose-Ponoka area. The small infestation which has persisted near the Gap Ranger Station in the Livingstone Forest Reserve was not visited in 1959.

Spruce Spider Mite, *Oligonychus ununguis* (Jac.)—The spruce spider mite did little damage in 1959. Mites were observed on many native spruce trees in the Rocky Mountain House district and on the Kananaskis Forest Experiment Station.

Pine Needle Scale, *Phenacaspis pinifoliae* (Fitch)—The infestation along the York Creek Road south of Coleman has subsided and only a light attack was reported in 1959.

Leaf Beetles, *Gonioctena americana* (Schaeff.), *Galerucella decora* (Say), *Galerucella carbo* Lec., *Dichelonyx backi* Kby., *Altica populi* Brown and *Altica plicipennis* Mannh.—Leaf beetles were present throughout the region in 1959 but did little damage. The American aspen beetle, *G. americana*, was found throughout south and central Alberta. Light infestations were reported from Waterton Lakes National Park, the Porcupine Hills, the Cypress Hills in the Clearwater Forest Reserve, and the Barrhead-Shining Bank-Peers-Wabamun Lake area. Moderate defoliation was reported from Innisfree and north of Lac La Biche in the east-central part of the Province. The grey willow-leaf beetle, *G. decora*, was reported from west-central Alberta. Adults were commonly found in the Edmonton-Fort Assiniboine-Mackay Corners area. Larvae caused severe damage to willow near Duffield turn off on Highway 16, and moderate damage along Highway 16 from Vermilion to Lloydminster. Elsewhere damage was light. The Pacific willow-leaf beetle, *G. carbo*, caused light to moderate defoliation of willow in the southern half of Kootenay National Park. The green rose chafer, *D. backi*, was less common than in 1958. It caused light damage to cinquefoil, shepherdia and rose 13 miles west of Banff and near Jasper. *Altica* spp. caused heavy damage to two acres of balsam poplar at Mile 240 on the Mackenzie Highway and to willow and balsam poplar around the eastern end of Lesser Slave Lake.

Fall Cankerworm, *Alsophila pometaria* (Harr.)—Infestations of the fall cankerworm remained much the same in 1959 as in 1958. Infested shelterbelts occurred south of Highway 9 and east of Highway 2. The heaviest defoliation occurred near Empress, Medicine Hat, Bow Island, and Claresholm, where moderate to heavy defoliation occurred.

Black-headed Budworm, *Acleris variana* (Fern.)—The black-headed budworm caused little damage in 1959. Light damage to alpine fir and spruce was reported along the Cascade Fire Trail from the Bow Valley to Jim Coon Creek in Banff National Park.

Aspen Leaf Miner, *Phyllocnistis populiella* Cham.—The aspen leaf miner was common in western Alberta in 1959. A heavy infestation occurred along the Yellowhead Road from Jasper to Geikie, and from the western boundary of Yoho National Park to Field. Light to moderate infestations were present throughout the remainder of Jasper, Banff, Yoho, and Kootenay Parks. Moderate to heavy infestations were observed at Rock Lake north of Entrance, in the Entrance-Hinton-Marlboro-Edson area, south of Grande Prairie and at Mile 281 along the Mackenzie Highway. Infestations of this leaf miner have shown a definite increase in size from those reported in 1958.

Engelmann Spruce Weevil, *Pissodes engelmanni* Hopk.—The infestation of the Engelmann spruce weevil near Kootenay Crossing, in Kootenay National Park, which has persisted for many years continued in 1959. This infestation which was first reported in 1950 has caused serious damage to regeneration spruce. Light infestations on white spruce were reported from Ottertail Creek in Yoho National Park, Rock Lake in west-central Alberta, and along the Pelican Mountain Road, 10 miles north of Calling Lake, in east-central Alberta.

Tent Caterpillars, *Malacosoma pluviale* (Dyar) and *Malacosoma lutescens* (N. & D.)—Fewer collections of these tent caterpillars were received in 1959

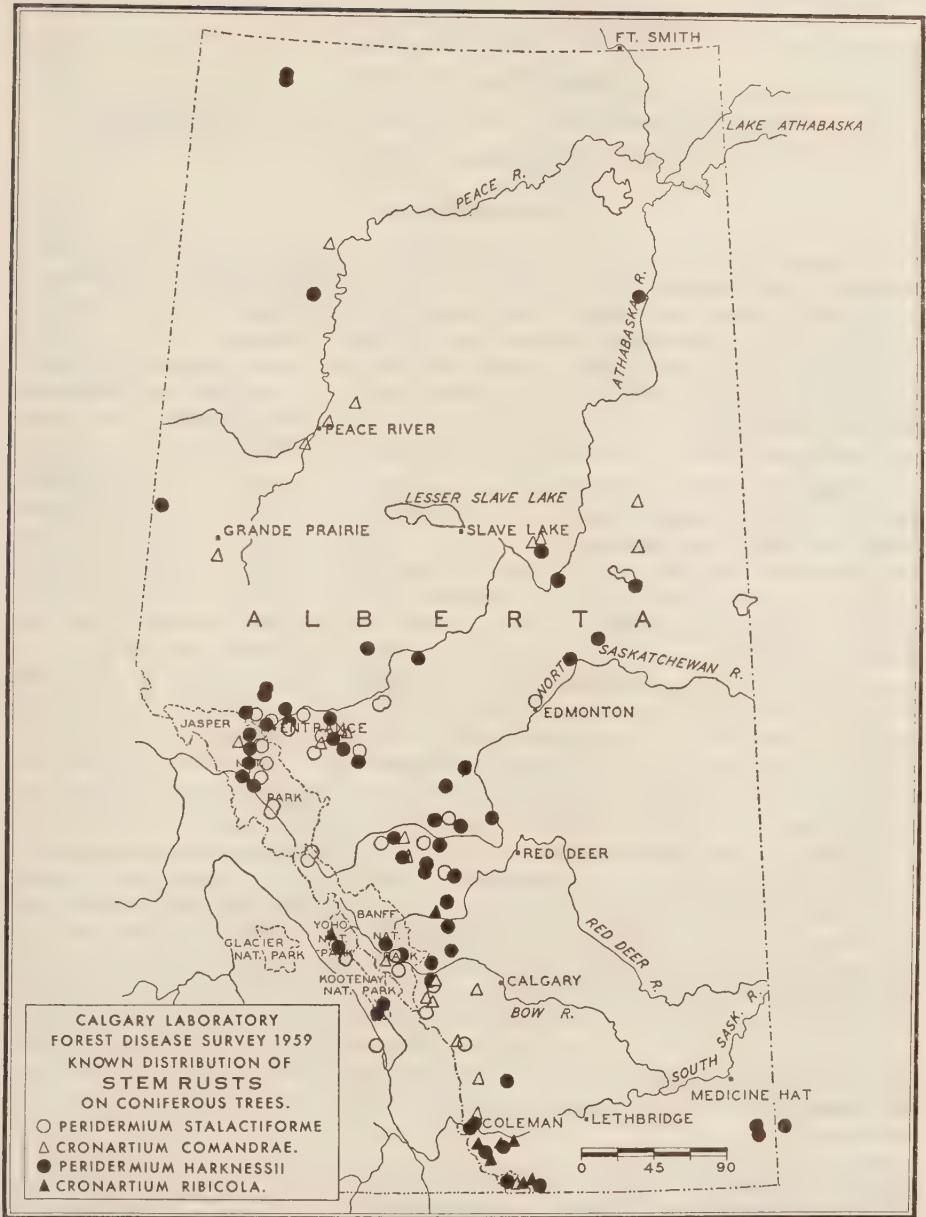
than in 1958. Both species were present in southern Alberta. A few tents of *M. pluviale* were observed throughout the southern half of the Peace River Block; the heaviest concentration of tents was near Saskatoon Lake.

A Poplar Scale, *Aspidiotus popularum* (Marlatt)—Two small infestations of this poplar scale were discovered in west-central Alberta in 1959. These infestations were approximately one acre in extent and 10 per cent of the trees in each were infested. This is the first infestation of poplar scale recorded by the Forest Insect Survey in Alberta. Large numbers of the twice-stabbed lady beetle, *Chilocorus stigma* (Say), were feeding on these scale insects.

An Alder Leaf Miner—A leaf miner believed to belong to the family Gracillariidae mined 60 to 80 per cent of the leaves of alder along the Pembina River between Evansburg and Entwistle and for 15 miles along Highway 43 west of the Athabasca Bridge. Moderate injury occurred along McPherson Creek south of Hargwen, and along many of the streams in the Grande Prairie and Slave Lake forest divisions.

OTHER NOTEWORTHY INSECTS

| Insect | Host | Locality | Remarks |
|---|---|---|---|
| <i>Adelges cooleyi</i> (Gill.) <i>Adelges lariciatus</i> (Patch) <i>Dendroctonus murrayanae</i> Hopk. | Douglas fir, spruce Spruce, tamarack Lodgepole pine | Southwestern Alberta Boreal region Ice River Road, Yoho National Park | Large numbers on Douglas fir. Increased number of galls. A few trees infested. |
| <i>Dendroctonus simplex</i> Lec. <i>Dryocoetes confusus</i> Swaine <i>Hyalophora cecropia</i> (L.) | Tamarack Alpine fir Boxelder, green ash, white elm Lodgepole pine | Lac La Biche Waterton Lakes Sterling, Skiff and Retlaw, Alberta Rocky Mountain House | Killed a few 6 and 7 inch dbh trees. Small number of trees infested. A few infested shelterbelts. |
| <i>Ips pini</i> (Say) | Spruce Lodgepole pine | Western Alberta Banff, Yoho, Kootenay, Jasper National Parks | 5 per cent of trees in a 60-acre stand attacked. Increased number of galls. Population levels low. |
| <i>Pineus prob. similis</i> (Gill.) <i>Recurvaria starki</i> Free. | | | |



PROVINCE OF ALBERTA

FOREST DISEASE SURVEY

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INTRODUCTION

Temperature inversions during the winter of 1958-1959 in the Rocky Mountains and adjacent high foothills resulted in winter injury, or 'red belt', to conifers in many localities. Less pronounced, although more widespread, occurrences of winter drying resulted from 'chinook' influences in forests of the low foothills and boreal region. Lodgepole pine was most seriously damaged. Severe late frosts were general in the Alberta region in late May and were particularly damaging to the aspen foliage. A relationship between late frosts and the disease known as 'clumping of aspen foliage' was indicated.

Numerous observations of infectious diseases were made during the year. Surveys of the *Atropellis* canker disease of lodgepole pine were continued. Dwarf mistletoe was detected in several new localities and unusually heavy infections were noted on jack pine near Lac La Biche. Needle casts of coniferous foliage were more abundant and widespread than in 1958, but did not reach epidemic proportion anywhere in the region. An ink-spot disease caused by *Sclerotium confundens* Whetz. caused the killing and premature shedding of aspen foliage near Lac La Biche and in the southern part of Kootenay National Park. Epidemics of branch and stem rusts were noted on several species of conifers. The associated fungi were mainly *Peridermium harknessii* J. P. Moore and *P. stalactiforme* Arth. & Kern. Foliage rusts were common, but only at endemic levels. The spruce cone rust however, was abundant on white spruce in the general Hinton-Whitcourt-Grande Prairie area.

Surveys of cull resulting from decay in commercially important tree species of Alberta were continued in cooperation with the Alberta Department of Lands and Forests. The survey of aspen and balsam poplar, begun in 1957 and terminated in 1959, was based on the examination of 1,362 trees. A survey of white spruce in the boreal forest region was commenced in 1959. This Laboratory also co-operated with the Department of Northern Affairs and National Resources, Ottawa, in a cull survey of balsam poplar in Wood Buffalo Park. In these surveys, the Laboratory provided technical guidance in planning and execution, and in the supervision of the analyses and interpretation of the data. The identification of the fungi associated with the decays was a Laboratory function.

The staff of the Plant Research Institute, Department of Agriculture, Ottawa, contributed substantially to the success of the Disease Survey by identifying a number of specimens. Thanks are due also to the Alberta Department of Lands and Forests and to private forest agencies for their reporting of disease conditions. A total of 883 collections were processed during the year including 568 cultures of wood-rotting fungi. A further 1,914 cultures remain

to be done at the time of writing. Twenty-nine new records of disease including 18 new host records were noted for the region in 1959. A summary of the collections made from the principal host trees is as follows:

| Coniferous Trees | Collections | Broad-leaved Trees | Collections |
|------------------------|-------------|----------------------|-------------|
| Pine | | Poplar | |
| Lodgepole pine..... | 498 | Trembling aspen..... | 169 |
| Jack pine..... | 20 | Balsam poplar..... | 28 |
| Limber pine..... | 7 | | |
| Whitebark..... | 5 | | 197 |
| | 530 | Cherry..... | 2 |
| Spruce | | White birch..... | 1 |
| White spruce..... | 94 | Total..... | 200 |
| Engelmann spruce..... | 7 | | |
| Black spruce..... | 4 | | |
| | 105 | | |
| Fir | | | |
| Alpine fir..... | 13 | | |
| Balsam fir..... | 3 | | |
| | 16 | | |
| Douglas fir..... | 4 | | |
| Juniper..... | 4 | | |
| Larch | | | |
| Western larch..... | 2 | | |
| Alpine larch..... | 1 | | |
| | 3 | | |
| Western red cedar..... | 1 | | |
| Total..... | 663 | | |
| Miscellaneous..... | | | 20 |
| Grand Total..... | | | 883 |

IMPORTANT DISEASES

Atropellis Canker of Pine—In 1959 the known distribution of the canker-causing fungus *Atropellis piniphila* (Weir) Lohman & Cash was increased by 11 areas not previously known to be affected. These areas were all located in west-central Alberta and with few exceptions more than 50 per cent of the lodgepole pines examined had one or more stem cankers. The affected areas exceeded one-quarter section in size in three widely separated localities, 23 miles east of Hinton, 10 miles east of Nordegg, and 20 miles south of Fox Creek. The ability of *A. piniphila* to infect very young trees was further demonstrated in a five-year-old basal infection on a 21-year-old pine. This infection had extended downward to the root collar.

Dwarf Mistletoe—Dwarf mistletoe (*Arceuthobium americanum* Nutt. ex Engelm.) was reported from 11 new localities during the year. Lodgepole pine was affected in four and jack pine in seven areas. Extensive infections were observed on lodgepole pine in three localities, 13 and 23 miles north of Coleman, and 10 miles south of Jasper. Mortality and top killing of trees was observed at each location. Heavy infections were noted on jack pine in five areas north, south, and west of Lac Biche. The largest of these was located 60 miles north of Lac La Biche and involved about 3,000 acres of nearly pure pine. All forms of damage that are peculiar to dwarf mistletoe were observed and trees of all age classes were affected. The hyperparasite *Wallrothiella arceuthobii* (Peck) Sacc. was noted only once during the year, near Lac La Biche where it was abundant on infected pine.

Leaf Spot and Ink Spot of Aspen—A leaf spot of aspen foliage, associated with *Marssonina tremuloidis* Kleb. and first reported in 1952 near Banff and Cochrane, was reported from Fort Vermilion in 1959. This disease was reported near Banff in 1953 at endemic levels following a period of greater abundance in 1952.

An ink spot of aspen foliage caused by *Sclerotium confundens* Whetzel was reported in two widely separated areas. This disease had been reported at endemic levels in 1953 near Hinton and Coleman and at greater intensities in 1954 at Whitecourt, Edson, and Jasper. In 1955 it was widespread in the foothills and Rocky mountains, but not as severe as in 1954. In 1959, *S. confundens* was recorded from about 15 miles east and west and 50 miles north and south of Lac La Biche, where about 10 per cent of the foliage on 25 per cent of trees was affected. A more localized outbreak was noted in the southern portions of Kootenay National Park. The bronzing and premature fall of affected foliage typical of this disease was observed in both areas.

Needle Cast of Lodgepole Pine—This disease which is caused by several closely related fungi was reported from 14 localities during the year. The affected areas varied from isolated small groups of trees to several hundreds of acres. The level of infection, although higher than in 1958, did not reach epidemic proportions in any locality. *Hypodermella montivaga* (Petrak) Dearn. was widespread in the southern portions of Kootenay National Park, but the level of infection on individual trees was low. *Lophodermium pinastri* (Schrad. ex Fr.) Chev. was similarly widespread in the Athabaska River valley south of Jasper. Small pockets of trees in other areas were lightly infected by both of these fungi as well as by *Hypodermella concolor* (Dearn.) Darker, *H. montana* Darker, and *Elytroderma deformans* (Weir) Darker.

Rust Diseases—Branch and stem infections caused by the rust fungi *Cronartium ribicola* J. C. Fisch. ex Rabenh. *C. comandrae* Peck, *Peridermium harknessii* J. P. Moore, *P. stalactiforme* Arth. & Kern., *Gymnosporangium clavariiforme* (Pers.) DC., and *G. globosum* Farl., were reported on six coniferous hosts from 94 localities during the year. Epidemic levels of infection occurred in 11 localities and were associated for the most part with *Peridermium harknessii* and *P. stalactiforme*.

The typical globose swellings of branches and stems that are associated with *P. harknessii* were noted in 43 localities on lodgepole pine and jack pine. This fungus was most damaging to young and pure stands of lodgepole pine and reached outbreak proportions in seven areas near Hinton, Robb, Muskeg River, and Hawk Hills. The extensive branch and stem cankers typical of *P. stalactiforme* were noted on lodgepole pine in 30 locations. Heavy damage was confined to young trees in six areas, generally in the vicinity of Hinton, Robb, Cadomin, and Berland River. The slight spindle swellings of *Cronartium comandrae* were noted in nine localities on lodgepole and jack pines. Serious injury only occurred on lodgepole pine and in one area near Robb, basal infections on young trees caused considerable mortality. White pine blister rust caused by *C. ribicola* was reported from 10 areas and was epidemic in two, on whitebark pine at York Creek and on limber pine at Sofa Mountain. Prior to the current year's observations this fungus had been noted at York Creek in 1953 and 1958 and at Sofa Mountain in 1958. In both areas, 100 per cent of trees up to about 65 years were infected.

The known distributions for four of the more important stem rusts of conifers in Alberta are illustrated in the accompanying map.

Rusts affecting the foliage and cones of coniferous trees were noted in 22 localities; the most conspicuous was the spruce cone rust fungus *Chrysomyxa*

pirolata Wint. It was abundant on white spruce in the general Hinton-Whitecourt-Grande Prairie area and occurred more sporadically on the same species south to Kananaskis. The foliage rusts, *Peridermium coloradense* (Diet.) Arth. & Kern., *Chrysomyxa ledi* de Bary, and *C. ledicola* Lagerh., were observed in seven widely separated localities on white and black spruces but none reached epidemic levels. *Coleosporium asterum* (Diet.) Syd. was observed on lodgepole pine in three areas but caused only minor damage. *Pucciniastrum geoppertianum* (Kühn) Kleb. and *P. epilobii* Otth were observed on the foliage of alpine fir, the former reaching outbreak proportions south of Grovedale. *Melampsora albertensis* Arth. caused minor damage to Douglas fir foliage near Waterton Park and *Melampsorella caryophyllacearum* Schroet. was associated with extensive brooming of balsam fir near the headwaters of Tony Creek.

Decay in Aspen and Balsam Poplar—The decay surveys in commercial stands of aspen and balsam poplar begun in 1957 in co-operation with the Alberta Department of Lands and Forests was concluded in 1959. The incidence of infection by wood-rotting fungi as revealed by examinations of 1,362 trees (835 aspens and 527 balsam poplars) was 73 per cent for aspen and 61 per cent for balsam poplar. The average age of aspen was 61 years and of balsam poplar 65 years. The loss in volume resulting from decay in aspen was 22 per cent (cu.-ft. basis) and 64 per cent (bd.-ft. basis). The losses in volume for balsam poplar were substantially less. The relative importance of fungi causing decay in both species was determined on the basis of 2,367 isolations from decayed wood and remained unchanged from that reported in 1958.

Winter Injury to Conifers—This disease, which is sometimes termed 'red belt' or 'winter drying', was severe in 1959 at numerous points within an area extending 50 miles east, 85 miles north, and 35 miles south of Jasper. Elsewhere the disease was of little consequence except near Rocky Mountain House. Lodgepole pine was most severely affected except near Brule and Rocky Mountain House where damage to white spruce was widespread. The most extensive damage was on the mountain slopes of the Athabaska River valley. Two areas near Mercoal and about 70 miles northwest of Entrance were affected to about the same degree as in 1958. These areas will be inspected in 1960 to determine if permanent damage of any consequence results from successive years of winter injury.

Clumping of Aspen Foliage—This general thinning and clumping of foliage near the extremities of branches was widespread on aspen in the foothills and adjacent boreal forests of Alberta in 1959. Additional symptoms of the disease were as reported in 1953. The apparently non-infectious nature of the disease and the probability of its resulting from climatic irregularities were further confirmed in 1959. The current damage was very similar to the effects of late frosts. In late May, late frosts were general in Alberta.

In Alberta, contiguous aspen stands may differ widely in the time required for foliage to flush and in the time this process commences. The leafing-out habit of a particular clone appears roughly similar each year. Certain aspen clones are, therefore, more vulnerable to late frosts than others, making such damage a chronic disease in some clones. Observations on leafing-out habits and weather conditions in five aspen stands, selected to exhibit a gradation in foliage symptoms, are now being made to provide further support for the above explanation.

OTHER NOTEWORTHY DISEASES

| Host | Organism | Locality | Remarks |
|--------------------------|---|--|---|
| Cherry, pin. | <i>Dibotryon morbosum</i> (Schw.) Theiss. & Syd. | Truman | Associated with branch swellings. New host record. |
| Fir, alpine. | <i>Auricularia auricula</i> (Hook.) Underw. <i>Peniophora pithya</i> (Pers.) Erikss. <i>Pucciniastrum goeppertianum</i> (Kühn) Kleb. | Kananaskis Forest Experiment Station Kananaskis Forest Experiment Station Cameron Lake and Muskeg River | On decomposing wood. New herbarium record. Associated with decaying wood of dead tree. New host record. Causing needle rust. New herbarium record. |
| Fir, balsam. | <i>Fomes pinicola</i> (Sw. ex Fr.) Cke. | Tony Creek | Associated with decay in standing dead tree. New host record. |
| Juniper, creeping. | <i>Gymnosporangium globosum</i> Farl. | Kananaskis Forest Experiment Station | Causing branch rust. New herbarium record. |
| Juniper, Rocky Mountain. | <i>Herpotrichia nigra</i> Hart. | Sofa Mt., Waterton Lakes National Park | Causing a smothering disease of seedlings. New host record. |
| Pine, jack. | <i>Armillaria mellea</i> (Vahl ex Fr.) Quéf. <i>Poria taxicola</i> (Pers.) Bres. | Fort Assiniboine Lower Peace River, Wood Buffalo Park | Associated with root and stem necrosis. New host record. Associated with decay in dead fallen tree. New host record. |
| Pine, limber. | <i>Lachnella fuscogrisea</i> (Rehm) Karst. <i>Neopeckia coulteri</i> (Pk.) Sacc. | Sofa Mtn., Waterton Lakes National Park Sofa Mtn., Waterton Lakes National Park | Associated with cankers on small branches. New herbarium record. Causing a smothering disease of seedlings. New herbarium record. |
| Pine lodgepole. | <i>Peniophora incarnata</i> (Pers. ex Fr.) Karst. <i>Polyporus leucospongia</i> Cke. & Harkn. | Kananaskis Forest Experiment Station Strachan | Associated with decay in dead standing tree. New herbarium record. Associated with decay in logging slash. New herbarium record. |
| Poplar, aspen. | <i>Hymenochaete tabacina</i> (Sow. ex Fr.) Lév. <i>Lenzites betulina</i> (L. ex Fr.) Fr. <i>Sclerotium confidens</i> Whetzel <i>Trametes suaveolens</i> (L. ex Fr.) Fr. | Whitecourt Crimson Lake Settler's Road, Kootenay National Park. Strachan | Cultured from decayed wood of living tree. New host record. Associated with decay in fallen tree. New host record. Causing a foliage ink spot. New herbarium record. Associated with decay in dead standing tree. New host record. |
| Poplar, balsam. | <i>Coprinus micaceus</i> Fr. <i>Fomes fomentarius</i> (L. ex Fr.) Kickx <i>Polyporus adustus</i> Willd. ex Fr. <i>Poria laevigata</i> (Fr.) Karst. <i>Trametes trogii</i> Berk. | Goodwin Lower Peace River, Wood Buffalo Park. Lower Peace River, Wood Buffalo Park. Lower Peace River, Wood Buffalo Park. Whitecourt | Cultured from decayed wood of living tree. New herbarium record. Associated with decay in living tree. New host record. Associated with decay in dead standing tree. New host record. Associated with decay in dead standing tree. New herbarium record. Cultured from decayed wood of living tree. New herbarium record. |
| Poplar, hybrid. | <i>Cytospora chrysosperma</i> Fr. | Calgary | Associated with stem and branch cankers on living tree. New herbarium record. |
| Spruce, Engelmann. | <i>Fomes subroseus</i> (Weir) Overh. <i>Stereum chaillatii</i> (Pers. ex Fr.) Fr. | Kananaskis Forest Experiment Station Kananaskis Forest Experiment Station | Associated with decay in fallen tree. New host record. Associated with decay in fallen tree. New host record. |
| Spruce, white. | <i>Aleurodiscus amorphus</i> (Pers.) Rabenh. ex Cooke <i>Merulius himantoides</i> Fr. <i>Polyporus abietinus</i> Dicks. ex Fr. | Waskahigan River Fox Creek Pass Creek | Associated with superficial canker on branch of living tree. New host record. Cultured from decayed wood of living tree. New herbarium record. Associated with decay in fallen tree. New host record. |
| Willow, sp. unknown | <i>Polyporus squamosus</i> Mich. ex Fr. | Exshaw | Associated with decay in living tree. New host record. |

PROVINCE OF BRITISH COLUMBIA

FOREST INSECT SURVEY

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INTRODUCTION

The field season of 1959 was characterized by some interesting changes in the status of several chronic insect pests. The black-headed budworm, which was at a low population level following the collapse of the outbreak on Vancouver Island in 1957, increased to major infestation proportions in the Queen Charlotte Islands. Numbers of larvae collected per sample were larger than obtained previously, and some hemlock stands which have not recovered from the previous outbreak are already in critical danger. Black-headed budworm numbers also increased along the northern mainland coast.

The spruce budworm infestation in the Lillooet and Fraser River valleys collapsed after an outbreak period of six years. In the Babine Lake area the two-year-cycle spruce budworm infestation continued unabated. Very large larval populations were present and barring any unforeseen mortality, defoliation is expected to be heavy in 1960. Farther north a small one-year-cycle spruce budworm infestation in the Liard River Valley caused up to 98 per cent defoliation of the current year's growth.

The balsam woolly aphid, whose presence in British Columbia was verified in 1958, has killed over 3,900 amabilis fir, ranging up to 50 inches D. B. H., and many more trees are under heavy attack.

Several species of loopers increased in abundance or remained at relatively high levels. About 550 acres of Stanley Park, Vancouver, were sprayed to protect the aesthetically valuable mature and overmature western hemlock.

No major infestations developed in the Interior. Population levels of defoliators generally were reduced. One of the most noticeable occurrences, although of little economic importance, was the presence of numerous patches of *Ips*-killed red-topped ponderosa pine trees.

The insect collections submitted by the British Columbia Forest Service personnel and by other co-operators are gratefully acknowledged. Sincere thanks also go to members of the British Columbia Loggers' Association and the provincial Forest Service for their assistance in the use of aircraft, vehicles, men, and accommodation.

The Victoria Laboratory received 2,733 insect collections and the Vernon sub-laboratory 3,061 for a total of 5,794. This was an increase of 657 compared with 1958. Collections received during 1959 were distributed among the principal tree species as follows:

| Coniferous Trees | Collections | Broad-leaved Trees | Collections |
|-----------------------|-------------|----------------------------|-------------|
| Hemlock | | Poplar | |
| Western hemlock..... | 997 | Trembling aspen..... | 165 |
| Mountain hemlock..... | 26 | Black cottonwood..... | 93 |
| | 1,023 | Silver poplar..... | 11 |
| | | Balsam poplar..... | 4 |
| | | Lombardy poplar..... | 3 |
| Douglas fir..... | 949 | Miscellaneous poplars..... | 6 |

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| Coniferous Trees | Collections | Broad-leaved Trees | Collections |
|--|-------------|----------------------------|-------------|
| Spruce | | Alder | |
| White spruce..... | 403 | Red alder..... | 89 |
| Engelmann spruce..... | 204 | Sitka alder..... | 31 |
| Sitka spruce..... | 119 | Mountain alder..... | 29 |
| Black spruce..... | 71 | Green alder..... | 2 |
| Miscellaneous spruces..... | 3 | Miscellaneous alders..... | 41 |
| | 800 | | 192 |
| Pine | | Birch | |
| Lodgepole pine..... | 459 | White birch..... | 33 |
| Ponderosa pine..... | 227 | Dwarf birch..... | 19 |
| Western white pine..... | 82 | Water birch..... | 11 |
| Miscellaneous pines..... | 4 | Western white birch..... | 5 |
| | 772 | Miscellaneous birches..... | 45 |
| Fir | | | 113 |
| Alpine fir..... | 260 | Willow..... | 245 |
| Amabilis fir..... | 88 | Garry oak..... | 52 |
| Grand fir..... | 55 | Cherry..... | 45 |
| Balsam fir..... | 3 | Maple..... | 16 |
| | 406 | Broadleaf maple..... | 14 |
| Western red cedar..... | 161 | Dogwood..... | 10 |
| Larch | | Apple..... | 9 |
| Western larch..... | 83 | Arbutus..... | 5 |
| Tamarack..... | 35 | Hazelnut..... | 5 |
| European larch..... | 2 | Miscellaneous broad-leaved | |
| Miscellaneous larch..... | 5 | trees..... | 194 |
| | 125 | | |
| Juniper | | Total..... | 1,182 |
| Rocky mountain juniper..... | 44 | | |
| Common juniper..... | 17 | | |
| Miscellaneous juniper..... | 1 | | |
| | 62 | | |
| Miscellaneous coniferous trees... | 5 | | |
| Total..... | 4,303 | | |
| Miscellaneous hosts or no hosts specified..... | | | 309 |
| Grand Total..... | | | 5,794 |

IMPORTANT INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)—The one-year-cycle spruce budworm infestation in the Lillooet and Fraser River areas has collapsed after causing heavy defoliation to Douglas fir trees since 1954. An aerial survey on July 29 failed to detect any signs of defoliation.

A trace of defoliation was observed on new foliage in one area along Seton Lake and at Skookumchuck and Rogers Creek in the Lillooet River and Lake region. Tree recovery appeared to be good; tops which were completely stripped of all foliage put out buds and green shoots in 1959. In localities where defoliation has been light for two or three years, foliage appears to be almost back to normal. Very few larvae were found during the feeding period, and only five egg masses were found in 1959, two at Tisdall, and three at a Tenas Lake plot. Egg mass counts along the Lillooet River averaged only 1.7 per 100 square feet of foliage compared with 26 for 1958. No egg masses were found along Anderson and Seton lakes or in the Fraser River Valley.

Elsewhere in the Vancouver District larvae were collected in small numbers at scattered localities.

Farther north, along the Alaska Highway between mileages 490 and 540, the one-year-cycle budworm was common and at a few points damaged from 50 to 98 per cent of the current year's buds of white spruce. The largest numbers were in the Liard River Valley. In one instance larch trees were severely defoliated over an area $\frac{1}{2}$ by $1\frac{1}{2}$ miles.

The two-year-cycle spruce budworm outbreak in the Babine Lake region of the Prince Rupert Forest District continued unabated in 1959. Early counts indicated the larval population was as heavy as any recorded to date. In 11 white spruce plots sampled, 86.2 per cent of the buds examined were infested, and in 15 alpine fir plots 82.1 per cent of the buds were infested. Damage at this stage was light, probably as a result of the cool, damp spring which apparently slowed the feeding rate considerably. This also enabled the trees to produce more foliage than in the past few years. A re-examination in late July and early August disclosed that heavy feeding had occurred. The heaviest damage was at the Smithers Landing-Mine Road Junction where all the 1959 foliage was lost, and, of 633 buds examined, 511 were killed and the remainder completely defoliated. Current defoliation of other stands along Babine Lake was estimated at 75 per cent with the percentage of buds killed ranging from about 9 to 40 per cent.

As this was the first, and light-feeding year of the two-year-cycle form, no estimate of the outbreak area was obtained, but there was no indication of any reduction in the infestation. Barring any unforeseen mortality, heavy defoliation can be expected in 1960. Although most stands are in fair condition, continued defoliation could have serious consequences as occasional heavily defoliated trees have already died.

Larvae were also abundant at sample plots on Pinkut Lake, Taltapin Lake, and west of Walcott Station. Larvae were collected in small numbers throughout most of the remainder of the East Prince Rupert District.

There was a small increase over 1957 in the population level of the two-year-cycle budworm in spruce and alpine fir in the southern portion of Prince George Forest District. Sampling indicated that moderately heavy populations were present, among other points, at Genevieve Lake, Willow River, Strathnaver, Manson Creek Road, Takla Lake, Trembleur Lake, Tudyah Lake, and Silver Sands Creek. Most two-year-cycle budworm larvae do not develop beyond the fourth instar in odd-numbered years such as 1959. Collections: Coast 108, Interior 125.

Black-headed Budworm, *Acleris variaria* (Fern.)—The black-headed budworm outbreaks on the Queen Charlotte Islands increased to heavy proportions in 1959. Collections of 600 larvae per three-tree beating sample were common from Skidegate Inlet south to Jedway on Moresby Island, and along the north side of Skidegate Channel on Graham Island. Defoliation was not as heavy as expected in proportion to the larvae present. The heaviest damage was on Moresby Island with medium to heavy damage common from Skidegate Inlet south to Jedway. Western hemlock stands at Copper Creek, near Aero Camp on Gillatt Arm, Lagoon Inlet, Newcombe Inlet, and Barrier Bay in Tasu Sound have not recovered from the previous black-headed budworm outbreak which subsided in 1955. This old damage is still evident in the dead tops, present in the stands. As many as 60 per cent of the trees are now totally defoliated.

An egg and tree damage survey was conducted in October, 1959 with the financial support of the B. C. Loggers' Association which supplied aircraft, ground transportation, accommodation, and fallers. A total of 82 points were sampled. The egg count for each sample point was the average number of eggs per 10-inch branch tip based on five tips from the upper crown level of each of three trees. Medium numbers of eggs were found at only two points on Graham

Island, at Tow Hill and Awun Lake. The heaviest egg counts were between Skidegate Inlet and Cumshewa Inlet where the number of eggs ranged to 76.7 at South Bay. This was also the area of heaviest budworm damage in the last outbreak.

Eight points sampled in 1958 averaged 7.2 eggs. The same points sampled in 1959 averaged 18.3 eggs, more than a two-fold increase. The small number of samples in 1958 makes it difficult to state that the increase is actually two-fold but the number of eggs in 1959 is significantly greater than in 1958.

Parasitism was very light. Less than one per cent of the larvae collected from Graham Island and reared were parasitized. Parasitism was higher on Moresby Island, averaging five per cent, but the majority of the parasites were obtained from only four collections in which parasitism varied from 12 to 24 per cent. No evidence of virus disease was found.

High hazard stands, which are considered in immediate danger of heavy defoliation, top-kill, and possibly some tree mortality total about 30,000 acres. These stands are all in the Skidegate Inlet-Cumshewa Inlet area and are as follows: South Bay to Alliford Bay, Copper Creek, and at the head of Gillatt Arm. An aerial spray program is proposed for June, 1960.

Increases in the black-headed budworm population level also occurred along the mainland coast from Bella Coola to Portland Canal. Three-tree beating samples on Princess Royal Island averaged 12 larvae, with a maximum of 45. An increase occurred in the Portland Canal-Observatory Inlet area where up to 49 larvae and 13 pupae were collected in individual samples.

On northern Vancouver Island black-headed budworm numbers remained at a very low level in 1959. Larvae were collected in small numbers, and egg counts made at 28 sample points averaged 0.042 eggs per 10-inch tip compared to 0.024 eggs per sample in 1958.

In the Interior the black-headed budworm declined to a very low level in 1959. Collections: Coast 256, Interior 78.

Balsam Woolly Aphid, *Adelges piceae* (Ratz.)—The known range of the balsam woolly aphid in British Columbia was increased in 1959. Groups of heavily attacked amabilis fir were observed on the west side of Howe Sound at Dakota Creek, Rainy River, and Potlatch Creek. The insect was also found attacking grand fir at Thetis Lake Park and in Beacon Hill Park, Victoria.

The balsam woolly aphid attack on the mainland has resulted in heavy tree mortality. During a two-hour aerial survey 3,900 dead and dying trees were recorded in the Howe Sound, West and North Vancouver areas. The heaviest mortality occurred in Cypress Creek where an estimated 2,000 dead amabilis fir were visible from the air. Ground plots and strip cruises showed that the dead trees were generally mature and overmature, and ranged from 10 to 50 inches D. B. H. In addition to the trees counted in the aerial survey, considerable numbers of green amabilis fir of all diameters are suffering from gout attack with occasional trees showing stem attack. Tree mortality can be expected to continue.

During examination of infested trees in plots on Grouse and Seymour mountains in North Vancouver it was noted that many amabilis fir in the area were attacked by a bark beetle which has been identified as *Pseudohylesinus* sp. Close examination showed that attacks in all green trees consisted of nothing more than a penetration of the bark into the cambium or to the wood surface. In three cases where the foliage was red, successful bark beetle galleries were found. The death of these trees was apparently caused by the balsam woolly aphid with the bark beetle attacks being strictly of a secondary nature.

Periodic observations carried out during the summer and fall resulted in a number of predacious mites and syrphids being recorded as attacking the balsam woolly aphid but no predators capable of exerting any marked degree of control were found.

Douglas-fir Beetle, *Dendroctonus pseudotsugae* Hopk.—In the Cariboo region, Douglas-fir beetle populations persisted at about the 1958 levels; elsewhere there was an apparent decline. In some localities the summer flight was greater than the spring flight.

In the coastal region no living trees were found to be attacked. Heavy beetle concentrations were found in felled and bucked timber at Pine River near Pemberton and in the Van West Logging operations near Comox.

Mountain Pine Beetle, *Dendroctonus monticolae* Hopk.—The mountain pine beetle continued to kill white, ponderosa, and lodgepole pine at about the same rate as in 1958. Particularly noteworthy current infestations were as follows: in white pine—Trinity Valley and Mabel Lake, Kamloops Forest District; Silverton Creek and Upper Arrow Lake, Nelson Forest District; in ponderosa pine—Long Lake and Alleyne Lake, Kamloops Forest District; in lodgepole pine—along Lussier River near the junction of Coyote Creek, and along Elk Creek at the junction of White River, Nelson Forest District. A heretofore unrecorded infestation was discovered along a new roadway in the Kettle River Valley between Damfino and Winnifred creeks. Aerial reconnaissance showed that over 1,000 lodgepole pines, have been killed during the past five years.

The severe mountain pine beetle outbreak in lodgepole pine along the east shore of Babine Lake in the Prince Rupert District continued to decline. Only scattered red tops were observed.

Engelmann-spruce Beetle, *Dendroctonus engelmanni* Hopk.—The Engelmann-spruce beetle persisted at a low population level in the Nelson Forest District. Spruce trees containing 100,000 fbm were killed in 1958 at Forster Creek. No new beetle attacks were observed at Bighorn or Grave creeks. Logging of infested trees on other localities further reduced beetle numbers.

In the Kamloops Forest District there were light attacks in Engelmann spruce at Vavenby, Sock Lake, and on White Rock Mountain.

A Spruce Beetle, *Dendroctonus* sp.—Tree mortality continued in a localized beetle outbreak four miles southwest of Smithers in the Prince Rupert District. Mortality now totals 33,800 cubic feet, an increase of 12,800 cubic feet over 1958. Logging operations now in progress are expected to salvage most of the timber.

White spruce stands on six timber sales from Cedarvale to Kitwanga Lake in the Prince Rupert District have suffered heavy mortality from spruce bark beetles. The attacks are subsiding; in some areas no green infested trees were observed. Information from the British Columbia Forest Service indicated tree mortality in some localities was as high as 90 per cent of the stands. Both mature and immature spruce are dead or being killed.

Red Turpentine Beetle, *Dendroctonus valens* Lec.—The red turpentine beetle was frequently associated with the *Ips* infestations in ponderosa pine. *Ips oregoni* attacked portions of the crown whereas *D. valens* attacked the basal six feet of the bole.

Western Cedar Bark Beetle, *Phloeosinus punctatus* Lec.—Injury by this bark beetle was very conspicuous in the cedar stands of the Vancouver Forest

District in 1959. Attacks were observed at McLean Creek, Powell River, Lund, on Texada Island, on southern Vancouver Island, Cultus Lake, and Silverdale. At Cultus Lake 78 dead trees and an additional 65 trees with dead tops were counted along 1.7 miles of road. At Silverdale $\frac{1}{4}$ or more of the upper crown of 21 out of 46 trees on a 0.6 acre plot were heavily infested. Attacked trees ranged in size from 5 to 28 inches D. B. H.

Ambrosia Beetles, *Trypodendron lineatum* (Oliv.), and *Gnathotrichus retusus* (Lec.)—These ambrosia beetles continued to be common around soft-wood logging operation on the Coast. *Trypodendron* is by far the more numerous beetle. In 1959 attacks were lighter where susceptible logs were removed from the woods prior to the beetle flight. Losses in Vancouver Island from degraded lumber remained high. At Stanley Park, Vancouver, *Gnathotrichus* beetles were found attacking logs in densities up to 15 per square foot. Ambrosia beetles were active as far north as Terrace where *Trypodendron* attacks averaged 81 per square foot.

Western Balsam Bark Beetle, *Dryocoetes confusus* Sw.—The western balsam bark beetle in association with *Leptographium* continued its persistent insidious attack on alpine fir stands.

During aerial reconnaissance, several large stands of alpine fir, presumably killed by balsam bark beetles and *Leptographium*, were observed near the headwaters of three different waterways: Scotch Creek, Adams River, and West Kettle River. Numerous patches of dead alpine fir were observed along Winnifred Creek and in the upper reaches of Granby River Valley.

Dryocoetes persisted at McGillivray Lake, and Bolean Lake.

The Oregon Pine Engraver, *Ips oregoni* (Eich.)—Numerous small patches of infested ponderosa pine were apparent in the southern Interior in 1959. These were most frequent in the North Okanagan although they were observed at such widely scattered points as Princeton, Grand Forks, Skookumchuck, Elko, and McLure.

Most infestations were in immature pole-sized trees in farm woodlots adjacent to small-scale logging or land-clearing operations, or in windthrown trees. Occasionally *Dendroctonus valens* and *D. brevicornis* were associated with the engraver beetles; in most instances they followed *Ips* attack.

Long-horned Wood Borers in Spruce and Douglas fir, *Monochamus oregonensis* Lec.—In 1958, fires destroyed more timber than usual. Fire-killed spruce and Douglas fir trees were attacked by various wood borers, chiefly *Monochamus oregonensis*, the species that causes greatest devaluation of the wood because it penetrates deepest (average 2 to 4 inches in spruce). In the Prince George Forest District an equal number of samples was taken in the fall of 1959 from spruce trees in each of three classes with bark lightly, moderately, and severely burned in 1958 fires. Samples were taken from burns that occurred at three different times of the year. The average number of *Monochamus oregonensis* tunnels per square foot in these samples is as follows: May 22 burn, 'Lin fire'—1.29; June 6 burn 'Fir fire'—1.24; July 18 burn, Tudyah Lake fire—0.05. The range in the number of tunnels per square foot on these three burns was 0 to 10.5.

Western Hemlock Looper, *Lambdina fiscellaria lugubrosa* (Hlst.)—Although no serious infestations developed in 1959, western hemlock looper larvae were common in coastal hemlock stands as far north as the Bella Coola Valley. The largest numbers were found in the South Vancouver District where a maximum of 24 larvae per three-tree beating sample were collected at Seymour River, 19 larvae per sample at Coquitlam Lake, and up to 8 larvae

per sample at Indian Arm, Stave Lake, Pitt Lake, and Maple Ridge Park. The highest numbers were again found in Stanley Park where up to 150 larvae were collected from a single tree. North of Howe Sound collections did not exceed 5 larvae.

On Vancouver Island larvae were common on the western side of the Island from the Nitinat and Caycuse River valleys where up to 7 larvae per sample were collected, to Holberg Inlet, where up to 14 larvae were collected at Wanakana Creek. Smaller numbers of larvae were collected in the Nimpkish River Valley.

As the hemlock looper is generally regarded as one of the most serious defoliators of hemlock, great interest is being focused on the population trend, but in no area has the looper been detected in sufficient numbers to cause undue alarm.

In Stanley Park, larvae were not numerous enough to cause tree mortality the aesthetic value of the mature and over-mature hemlock warranted chemical control action to prevent possible top-kill. About 550 acres of the western portion of the Park were sprayed on July 23 with 10 per cent DDT in fuel oil by Skyway Air Services Ltd. An estimated 98 per cent of the hemlock loopers were killed as well as about 90 per cent of the *Melanolophia imitata* Wlk. larvae present.

There was a continued general uptrend in western hemlock looper numbers in the Interior, although they are still low. Collections: Coast 114, Interior 110.

Poplar and Willow Borer, *Sternochetus lapathi* (L.)—This borer was common on Vancouver Island, in the Fraser River Valley, and along Howe Sound. In the Fraser River Valley, attacks were heavy from Mission to Rosedale where 57 to 83 per cent of the willow tallied were infested or dead. Trees ranged from $\frac{1}{2}$ to 4 inches D. B. H. Light attacks on black cottonwood were observed in several areas in the Fraser Valley and a plantation on the University of British Columbia Research Forest at Haney was also infested. Willows at Cowichan Lake and Nanaimo Lakes on Vancouver Island were heavily attacked.

In the Interior, the infestation has spread from Tranquille eastward throughout Brocklehurst and North Kamloops. Only willows have been attacked.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.—Very few larvae were collected and no defoliation was observed in the South Vancouver District. In the Prince Rupert District very heavy defoliation occurred near Kitwanga, Telkwa, and the Kispiox River. Aspen and birch trees around Hazelton and on the east side of the Bulkley River were almost completely defoliated. The trees were leafing out again by August. The large number of egg masses present in the fall point to heavy defoliation in 1960 from Kitwanga to about 15 miles east of Moricetown.

In the Interior a new light infestation was observed north of Nicholson. The infestation at McBride remained relatively unchanged. Larvae at Barton Creek, northwest of Adams Lake, were heavily parasitized and the population level declined although the infestation increased to cover some 750 acres. Egg counts in the fall indicated that the McBride infestation will persist but that the Barton Creek infestation has collapsed. Collections: Coast 13, Interior 6.

Western Tent Caterpillar, *Malacosoma plumiale* (Dyar)—The population on the Saanich peninsula remained at about the same low level as in 1958. No defoliation was observed. Only a few colonies were found elsewhere on Vancouver Island and the south-western mainland. The heavy outbreak near Terrace declined in intensity, although tents were still noticeable.

In the Interior the western tent caterpillar was not common in 1959. Only two or three tents of the form that attacks dwarf birch and willow were observed in the Prince George District. Collections: Coast 27, Interior 5.

Green-striped Forest Looper, *Melanolophia imitata* Wlk.—The population level of this looper remained high throughout coastal forests in the Vancouver Forest District. Despite the large number of larvae present defoliation was very light. This is due mostly to their habit of consuming entire needles rather than portions of them. On the mainland larvae were common from Vancouver north to Jervis Inlet. The largest sample, 111 larvae, was collected at Grouse Mountain. The population level decreased in Stanley Park as a result of chemical treatment in 1958. Larvae were present in nearly all samples from Vancouver Island, but were most numerous on the west coast from Tofino to Holberg Inlet where collections of over 100 larvae were common. Light defoliation was observed in Quatsino Sound, and in the Tsitika River Valley. The common host was western hemlock, followed by cedar, Douglas fir, and spruce. Collections: Coast 497, Interior 127.

Silver-spotted Tiger Moth, *Halisidota argentata* Pack.—Webs were more numerous in the spring of 1959 than in 1958 on the eastern portion of Vancouver Island from Victoria to Courtenay, at Cowichan Lake, on the Strait Islands, and on the mainland from Vancouver to Powell River. Although numbers are increasing there was no severe defoliation. Collections: Coast 45.

Pine Butterfly, *Neophasia menapia* Feld.—For the third consecutive year flights of the pine butterfly occurred on Vancouver Island. Adults were observed in the Nitinat River area, Muir Creek, and Englishman River, but the most spectacular flight occurred at Cathedral Grove where thousands of butterflies covered the trees and the road. There was no indication where the flights originated. Only one larva was collected, at Englishman River, during random sampling, and no defoliation was observed in Douglas fir stands in flight areas. Collections: Coast 8, Interior 2.

Sequoia Pitch Moth, *Vespamima sequoiae* (Hy. Edw.)—Ponderosa pine plantations at Green Timbers and Alouette Lake in the Fraser River Valley were heavily infested with this pitch moth. The attacks occur in the top portion of trees up to 8 inches DBH and result in terminal breakage from wind and snow. The pitch moth may be a serious restricting factor to the establishment of ponderosa pine in coastal areas.

Cooley Spruce Gall Aphid, *Adelges cooleyi* (Gill.)—These insects were very abundant on the needles and cones of Douglas fir in 1959. On southern Vancouver Island 100 per cent of the cones were often heavily attacked. In the Fraser River Valley most trees had a medium to heavy population of *Adelges* on current foliage. These insects were abundant on the needles of the alternate host, Douglas fir, in the Kamloops and Nelson forest districts. In eastern portions of Kamloops Forest District a great reduction in new galls on spruce was observed.

Satin Moth, *Stilpnotia salicis* (L.)—Satin moth larvae were numerous in some localities in the Interior but generally defoliation was less severe than in 1958. In some instances this followed extensive spraying in 1958. The known distribution remained unchanged. Recent outbreaks were noted in the following places: 15 miles north of Kamloops in the North Thompson Valley; one mile south of Knutsford, Pritchard, Shuswap, Falkland, and between Wood and Duck lakes.

On the Coast defoliation was confined to a small group of poplar trees in Victoria. Parasitism was relatively light. Collections: Coast 10, Interior 13.

Conifer Sawflies, *Neodiprion* spp.—Larvae of these sawflies were very common in collections from the coastal forests of Vancouver Island and from

the mainland as far north as Rivers Inlet. No defoliation was observed in any area. There were few noteworthy infestations of *Neodiprion* in the Interior during 1959. High population levels persisted on ponderosa pine near Deadman River and on lodgepole pine at Squilax. Collections: Coast 472, Interior 453.

Western Winter Moth, *Erannis vancouverensis* Hlst.—Garry oak, maple, and other miscellaneous broad-leaved trees were heavily defoliated in the Cedar Hill and Uplands districts of Victoria. An infestation of this insect, an unusual occurrence in the Interior, was observed at Agate Bay on Adams Lake. Some 10 acres of Douglas maple, birch, alder, and willow were severely defoliated. Collections: Coast 20, Interior 3.

Yellow-lined Forest Looper, *Nyctobia limitaria* Wlk.—This looper increased in numbers in the coastal forests in 1959. The largest numbers were found on the west coast of Vancouver Island where up to 127 larvae were collected in one three-tree beating sample in Quatsino Sound. Hosts included western hemlock, Douglas fir, and spruce. Collections: Coast 191, Interior 83.

Aspen Leaf miner, *Phyllocnistis populiella* Cham.—This miner was again abundant in the Interior. In the Yukon and northern British Columbia numbers increased in some areas and decreased in others. In the western portion of the Kamloops Forest District there was a general decline. Adults were observed in vast numbers from the first week in June until mid August.

The aspen leaf miner was less conspicuous in the Prince Rupert District in 1959. The infestation is now confined to localized spots.

Leaf Miners on Willow and Cottonwood, *Phyllocnistis* sp.—The outbreak of leaf miners on black cottonwood in the Skeena River Valley decreased in intensity.

Fall Webworm, *Hyphantria cunea* (Drury)—Fall webworm numbers increased in the Vancouver Forest District. Alders from Duncan to Courtenay on Vancouver Island were heavily defoliated. The infestation was heavy in the Fraser River Valley and reached its peak at Yarrow where up to 30 webs were counted on individual trees. The outbreak extended north to Powell River.

In the Interior fall webworm numbers decreased except along the Nicola River Valley from Merritt to Spences Bridge where the infestation was moderate. Collections: Coast 17, Interior 10.

Green Velvet Looper, *Epirrita autumnata* (Gn.)—Fewer collections were received in 1959 than in 1958. Larvae were common on Vancouver Island, particularly near Comox, and up to 30 larvae per sample were collected on Whitesail, Eutsuk, and Tetachuck lakes in the Prince Rupert District. The principal hosts were western hemlock and alpine fir. Collections: Coast 102, Interior 39.

Oak Looper, *Lambdina somniaria* Hlst.—Localized outbreaks occurred in the greater Victoria area. Larvae were very numerous in about four acres of Garry oak on Burnside Road, another area of similar size on Quadra Street, and in the Cedar Hill District. Defoliation was moderate. Collections: Coast 12.

Saddle-backed Looper, *Ectropis crepuscularia* Schiff.—The saddle-backed looper was collected in larger than usual numbers throughout western hemlock stands on the west coast of Vancouver Island where up to 41 larvae per sample were collected. Loopers were also common along the mainland coast; a maximum of 72 larvae per sample were collected at Draney Inlet. Collections: Coast 162, Interior 88.

Spruce Aphid, *Neomyzaphis abietina* (Wlkr.).—The heavy outbreak of spruce aphid on Sitka and blue spruce on the southern end of Vancouver Island and in the Fraser River Valley subsided in 1959.

Sitka-spruce Weevil, *Pissodes sitchensis* Hopk.—Over 50 per cent of the young spruce leaders in the Nitinat River and Museum Creek areas of Vancouver Island were attacked in 1959. With few exceptions all the young spruce trees have been attacked at least once in recent years.

Engelmann-spruce Weevil, *Pissodes engelmanni* Hopk.—Again small patches of immature spruce up to 5 and 10 acres in extent were attacked by the Engelmann-spruce weevil at widely scattered points in the central and southern Interior.

A Root-crown Weevil on Douglas fir, *Pissodes* sp.—Numerous open-grown partially red-topped Douglas fir trees, on a dry hillside near Lillooet, supported broods of *Pissodes* sp. about the root collars.

Willow Leaf Beetle, *Galerucella carbo* Lec.—This beetle was responsible for skeletonizing 50 to 80 per cent of the foliage of trembling aspens in the region around Springbrook, Nelson Forest District. It was numerous on willow throughout the District.

From Duncan to Port Alberni on Vancouver Island up to 100 per cent of willow and alder foliage was damaged. Heavy defoliation of willows also occurred on the mainland from Vancouver north to Bute Inlet, and on the Georgia Strait islands.

Flea Beetles, *Altica* spp.—Severe skeletonizing of alder leaves occurred near the Kelowna airport, at McCullough, and in numerous localities in the Nelson Forest District. Beetles were numerous on black cottonwood trees along Kootenay Lake.

Heavy defoliation of alder and poplar also occurred on southern Vancouver Island, particularly around Lake Cowichan.

Douglas-fir Tussock Moth, *Heemerocampa pseudotsugata* McD.—The population level remained very low. The small spot infestation near Lillooet disappeared in 1959.

Douglas-fir Needle Miners, *Contarinia* spp.—Douglas-fir needle miners persisted at low population levels in the southern Interior. Collections: Coast 5, Interior 27.

Pine Needle Scale, *Phenacaspis pinifoliae* (Fitch)—In 1959, pine needle scale numbers on ponderosa pine declined between Naramata and Okanagan Falls. An unusually high mortality of nymphs occurred in June.

Light to moderate infestations on ponderosa pine were seen at Summerland, Winfield, Nicola, Savona, and Dufferin Hill.

A heavy population on 10 acres of lodgepole pine was observed in the Bull River area, and at Yahk, Nelson Forest District. Moderate attacks occurred in lodgepole pine near Barriere.

Black Pine-leaf Scale, *Nuculaspis californica* (Coleman)—The black pine-leaf scale outbreak on ponderosa pine persisted at Campbell Mountain and south Penticton although at a lower level than in 1958. The small light infestation in Botanie Valley near Lytton remained unchanged.

Engraver Beetles, *Scolytus* spp.—Engraver beetle attacks were in evidence in the branches of living Douglas fir in the Kamloops Forest District and in larch in the Nelson Forest District.

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.)—This leaf roller severely defoliated trembling aspen north of Nicholson in the Nelson Forest District. Light to heavy infestations recurred along the Alaska Highway notably at Mile 1205 in Yukon Territory where some 500 acres of aspen were severely defoliated in 1959. Collections: Interior 4.

Larch Sawfly, *Pristiphora erichsonii* (Htg.)—There was a slight increase in the abundance of the larch sawfly on eastern larch in the Peace River district. Colonies were rare on western larch in the south. Collections: Interior 8.

Blotch Miners, *Lithocolletis* spp.—This blotch miner of aspen persisted in widely scattered localities but there were no severe infestations. The species attacking black cottonwood declined at Wood Lake, Kamloops Forest District.

Willow Leaf Blotch Miners, *Lyonetia saliciella* Busck—The occurrence of mined willow leaves was widespread in the Nelson Forest District. Miners were also numerous between miles 488 and 624 on the Alaska Highway: the percentage of leaves infested ranged from 0 to 60.

Ugly-nest Caterpillar, *Archips cerasivoranus* (Fitch)—The number of nests declined but they were still fairly numerous on choke cherries near Lytton, Kamloops, and in the Salmon River area, Kamloops Forest District; and at Elko, Ta Ta Creek, and Fairmont, Nelson Forest District. Collections: Interior 13.

Larch Shoot Moth, *Argyresthia laricella* Kft.—A systematic search was made for the larch shoot moth in British Columbia in 1959. Small numbers of infested shoots were collected in the eastern part of the Nelson Forest District along the Findlay Creek Road, Estella Mine Road, and adjacent to Canuck Creek. It was present in almost all larch stands in the western part of the Nelson Forest District. Mined shoots were most common near Midway and Wynndel where about one mined twig per young tree was recorded. There was some evidence of predation, presumably by birds.

Twig-infesting Cecidomyids, Itonididae—Several species including a *Retinodiplosis* were numerous in the 1959 candles and 1958 twigs of ponderosa and lodgepole pines. 'Flagging' and death of the branch terminals usually resulted. Although widespread, the only severe 'flagging' has occurred on ponderosa pine in east Kootenay, near Chase, and in the Okanagan Valley.

Balsam Twig Aphid, *Mindarus abietinus* (Koch)—A heavy infestation of the balsam twig aphid was present on several square miles of immature alpine fir south of McGillivray Lake. The new foliage of the infested trees was moderately discoloured.

Twig Aphid of Grand Fir, *Cinara occidentalis* (David.)—Heavy infestations were observed on grand fir at Creston, Fruitvale, and Big Sheep Creek, Nelson Forest District.

A Douglas-fir Cone Moth, *Barbara colfaxiana* Kft.—There was a heavy crop of Douglas fir cones in 1959, and this moth continued to be the most important pest in the Interior.

The greatest damage occurred in the Okanagan Valley where up to 62 per cent of the cones were infested. In the Nelson Forest District heavy infestations were recorded at Grand Forks, Brilliant, Skookumchuck, and Waldo.

A Cone Borer, *Dioryctria auranticella* (Grt.)—This cone borer persisted as an important pest of ponderosa pine. In general the cone crop was light and the borer infestations were medium to severe in eastern Kamloops and western Nelson forest districts.

Spruce Seedworm, *Laspeyresia youngana* (Kft.)—The heavy white spruce cone crop in Yukon Territory showed 26 to 74 per cent infestation by this seedworm.

Pine Needle Miner, *Zelleria haimbachi* Busck—This insect was numerous on lodgepole pine in the southern part of the Kamloops Forest District and on ponderosa pine in the eastern part of the Nelson Forest District. Greatest numbers, although only in moderate infestations, were at Vaseaux Lake and Wardner.

Pine Tube Moth, *Argyrotaenia pinatubana* (Kft.)—The infestation in lodgepole pine saplings in eastern Nelson Forest District declined.

Pine Shoot Borer, *Eucosma sonomana* Kft.—This pine shoot borer ranges from Elko in the Nelson Forest District to the Okanagan and northward to Chase. In 1959, it was most numerous near Cascade where 44 per cent of the young ponderosa pine trees sampled were infested.

Bruce Spanworm, *Operophtera bruceata* (Hlst.)—In 1959, this insect severely defoliated trembling aspens from Little Prairie to Blueberry. Willow and rose leaves and occasionally spruce buds were also eaten. Collections: Interior 25.

PROVINCE OF BRITISH COLUMBIA

FOREST DISEASE SURVEY

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INTRODUCTION

Foliage diseases continued to be very common for the second consecutive year in British Columbia following three years of reduced abundance. *Elytroderma deformans* (Weir) Darker, *Hypodermella laricis* Tub., and *Rhabdocline pseudotsugae* Syd. were associated with the most widespread and severe damage.

Delayed effects of the severe 1958 drought appeared as increased root-rot mortality, dieback, and top-killing on several species. *Cytospora* sp. was prominent among the several fungi associated with crown damage.

Examinations of exotic plantations brought to light several fungi not previously recorded on these hosts in British Columbia.

Twenty-nine new records for British Columbia are listed in the 'Other Noteworthy Diseases' section of this report. A total of 2,419 disease samples were collected and processed during the 1959 field season and are summarized by host as follows:

| Coniferous Trees | Collections | Broad-leaved Trees | Collections |
|-------------------------|-------------|---------------------------|-------------|
| Douglas fir..... | 1,368 | Alder | |
| Fir | | Red alder..... | 26 |
| Alpine fir..... | 168 | Sitka alder..... | 7 |
| Grand fir..... | 22 | Other alders..... | 14 |
| Amabilis fir..... | 17 | | |
| | 207 | Willow..... | 47 |
| Pine | | Aspen, trembling..... | 60 |
| Lodgepole pine..... | 89 | Birch, western white..... | 31 |
| Ponderosa pine..... | 44 | Cottonwood, black..... | 18 |
| Western white pine..... | 29 | Maple, broadleaf..... | 16 |
| Scots pine..... | 18 | Arbutus..... | 4 |
| Red pine..... | 15 | Oak, Garry..... | 3 |
| | 195 | Ash, mountain..... | 3 |
| Hemlock | | Cherry..... | 1 |
| Western hemlock..... | 103 | Total..... | 184 |
| Mountain hemlock..... | 2 | | |
| | 105 | | |
| Spruce | | | |
| White spruce..... | 39 | | |
| Sitka spruce..... | 16 | | |
| Black spruce..... | 11 | | |
| Engelmann spruce..... | 10 | | |
| Other spruce..... | 6 | | |
| | 82 | | |
| Larch | | | |
| European larch..... | 10 | | |
| Western larch..... | 2 | | |
| Dahurian larch..... | 3 | | |
| Japanese larch..... | 2 | | |
| | 17 | | |

| Coniferous Trees | Collections |
|--|-------------|
| Juniper | |
| Common juniper..... | 10 |
| Rocky Mountain juniper..... | 2 |
| Creeping juniper..... | 1 |
| | <hr/> |
| | 13 |
| Cedar | |
| Western red cedar..... | 5 |
| Port Orford cedar..... | 4 |
| Yellow cedar..... | 1 |
| | <hr/> |
| | 10 |
| Yew, western..... | 5 |
| Cypress, Monterey..... | 1 |
| | <hr/> |
| Total..... | 2,003 |
| Miscellaneous or host not specified..... | 232 |
| Grand Total..... | 2,419 |

IMPORTANT DISEASES

Weather Injury—Weather injury records in 1959 included the delayed effects of the severe 1958 drought, frost damage, and hail injury.

Continued damage resulting from the past year's severe drought affected several tree species in one form or another. Reports of dieback, sunscald, and mortality of Douglas fir were received both from areas damaged in 1958 as well as from areas which apparently escaped direct injury. Dieback and flagging of pole-sized and older trees and mortality of reproduction was recorded in the Lillooet area, although not reported as affected in 1958. Dieback and top-kill of pole-sized and mature trees on lower Vancouver Island were also ascribed to the delayed effects of this drought. *Cytospora* sp. was commonly associated with killed leaders and branches. Lodgepole pine suffered similar damage in the Prince George and Vanderhoof areas where other species apparently escaped injury. The 1958 drought combined with infection by *Elytroderma deformans* accounted for 25 per cent mortality of yellow pines under 4 inches D.B.H. in a small stand near Clinton. Premature twig cast and top-kill of western red cedar were particularly noticeable in the Interior Wet Belt region.

Winter damage to lodgepole pine at Mile 471 and 481 on the Alaska Highway followed the pattern of previous years with the discolored trees occurring in a belt at about the 4,000-foot elevation.

An unusually severe hail storm took place on August 18 on the north slope of Tabor Mountain in the Prince George District. Alder and aspen trees suffered 80 per cent defoliation while the ground cover was almost completely stripped of foliage. Although bark injury did occur the extent of the damage is unknown.

Root Diseases—An increase in the number of reports of *Armillaria mellea* (Vahl ex Fr.) Quél. both in natural stands and plantations was ascribed to predisposition by the 1958 drought.

Several new infection foci of root rot caused by *Poria weirii* Murr. in Douglas fir stands were recorded in the Okanagan, Arrow, and Slocan Lakes areas. While the fungus has been known in these regions for some years, recent records suggest that damage is more common than early observations suggested. The more frequent reports of this root rot in recent years should, however, be ascribed to a more general recognition of the disease rather than to a sudden increase in its incidence.

Foliage Diseases—The infection level of foliage diseases remained high for the second consecutive year. Needle blight of yellow pine caused by *Elytroderma deformans* was again heavy in most areas severely defoliated in 1958. Several new areas of moderate to severe infection were noted. Lower-branch mortality in heavily infected stands was common and smaller trees showed a marked decline in vigour. There was a notable increase in the incidence of infected lodgepole pine, particularly in the Kamloops and Cariboo regions.

Larch needle cast, caused by *Hypodermella laricis*, was generally more common and severe throughout the range of western larch than in 1958.

Douglas fir needle blight, caused by *Rhabdocline pseudotsugae*, continued at outbreak levels in Christmas tree stands in the East Kootenay Region. Heavy infection levels were also noted in other Douglas fir regions, particularly in young stands on Vancouver Island.

The frequent reports of foliage rusts suggested a favourable year for the development of these parasites.

Melampsora rust of Douglas fir—A rust caused by *Melampsora albertensis* Arth. or *M. occidentalis* Jacks. caused premature shedding of the foliage of Douglas fir and of the alternate hosts, aspen and cottonwood. The disease occurs wherever aspen or cottonwood are growing with Douglas fir.

The following noteworthy observations were made recently:

- (1) *M. occidentalis* may occur beyond the natural range of Douglas fir; it has been collected on eastern cottonwood at Saskatoon, and on black cottonwood at Salvus, B.C., in the Prince Rupert Forest District. Since there is evidence that the fungus does not overwinter on cottonwood in the uredinial state, it may be assumed that infection of the cottonwood was caused by aeciospores, produced on Douglas fir and wind-borne over a distance of nearly 100 miles.
- (2) *Melampsora* rust may cause considerable damage to Douglas fir seedlings in nurseries established beyond the natural range of Douglas fir. This situation exists in a nursery near Terrace, B.C., where *Melampsora occidentalis* caused severe defoliation to both Douglas fir seedlings and black cottonwood trees surrounding the nursery.
- (3) Certain varieties of artificially bred poplar hybrids are alternate hosts of *M. occidentalis*. Thus, even in the absence of the naturally occurring alternate hosts, Douglas fir could become infected where these hybrids are planted. Poplar varieties 'Brooks No. 10' and 'Gelrica' were infected by *M. occidentalis* in a plantation near Nelson, B.C., apparently representing first records of this rust on these two varieties of hybrid poplar.

Comandra Blister Rust in the Yukon—The Comandra blister rust fungus, *Cronartium comandrae* Peck, causes the same symptoms and type of damage on hard pines as white pine blister rust, caused by *C. ribicola* J. C. Fisch., does on white pines. It can be exceedingly destructive to seedlings and saplings, which are frequently killed by girdling the stem near ground level. In the Teslin-Whitehorse area, mortality resulting from Comandra blister rust of 5 to 10 per cent was common in sapling lodgepole pines. This damage to young trees in the southern Yukon Territory must be ascribed primarily to the relative abundance of northern comandra, *Geocaulon lividum* (Richards.) Fern., an alternate host of the Comandra blister rust.

Comandra blister rust has been reported previously as causing cankers on the boles of mature lodgepole pine as well as on saplings and seedlings near Kelowna and Fort Babine, British Columbia, but the rust has apparently not been reported from the Yukon and Alaska.

Douglas-fir Decline—A condition of early decline and mortality of Douglas fir was reported from several areas of the Interior Wet Belt Forest by officers of the British Columbia Forest Service. Preliminary reconnaissance indicated decline symptoms of thin foliage, reduced crown length, twig and branch mortality, and marked increment decline for 8 to 20 years before death. Shoestring root rot caused by *Armillaria mellea* was commonly associated with dead and dying trees, but did not appear to be a primary factor. The condition appeared to be confined to trees over 80 years old. The examinations revealed an almost consistent occurrence of needle cast caused by *Rhabdocline pseudotsugae* Syd. This was the first British Columbia record of *Rhabdocline* infection on trees of this advanced age group. The relation, if any, of the needle cast to the decline was not revealed in the preliminary examinations. A detailed examination of 20 sample plots was carried out during October.

Disease of Non-indigenous Trees—Physiological diseases and animal damage continued to be the most important damaging influences in exotic plantations but a number of fungi have been found associated with diseases of several species in 1959.

Several European larch 6 to 12 feet high were recently killed by root rot on southern Vancouver Island. *Armillaria mellea* was isolated in pure culture from the roots. Young Scots pines and red pine seedlings were similarly infected on the northern part of the Island.

Two varieties of hybrid poplar, 'Grandis' and 'Regenerata', were found infected with yellow leaf blisters caused by *Taphrina populina* Fr. This disease has previously been reported as infecting Lombardy poplar, but infection of these two hybrids may be a new world host record.

Disease Conditions in Forest Nurseries—Damage from damping off remained at endemic levels at the Cranbrook, Green Timbers, and Duncan nurseries. For the first time since its establishment, late damping off in the Quinsam nursery reached substantial damage levels. Losses up to 25 per cent were sustained in a few of the beds.

Infections of grey mould blight, caused by *Botrytis cinerea* Pers. ex Fr. resulted in losses in the more densely stocked beds of 2-0 Douglas fir at Green Timbers. Damage resulted from mortality and killing of the current year's shoots. Since damaged seedlings must be culled, top damage is just as serious as mortality. Damage was more severe at Duncan where losses up to 14 per cent were sustained in densely stocked beds.

OTHER NOTEWORTHY DISEASES

| Host | Organism | Locality | Remarks |
|-------------------|--|----------------------|--|
| Bearberry, alpine | <i>Pucciniastrum sparsum</i> (Wint.) E. Fisch. | Dawson, Y.T. | Aerial state causes a needle rust of spruce in Europe. Apparently surviving as a parasite of bearberry without completing its full life cycle on spruce. First record for Yukon, although known to occur in B.C. and Alaska. |
| Cottonwood, black | <i>Marssonina populi</i> (Lib.) Sacc. | Queen Charlotte City | Causing leaf spot disease and general browning of upper leaf surface; also occurs on trembling aspen. |
| Fir, alpine | <i>Arceuthobium campylopodum</i> Engelm. | Cranbrook and Fife | Causing fusiform swellings of branches. Apparently an infection from dwarf mistletoe on western larch growing in close proximity. Reported from Montana and Oregon by L. S. Gill (1935). |

OTHER NOTEWORTHY DISEASES—Continued

| Host | Organism | Locality | Remarks |
|---------------------|--|--|---|
| Fir, alpine (Con't) | <i>Ascoalyx abietis</i> Naumov | Chase and Smithers | Associated with the dying of branches. |
| | <i>Cytospora</i> sp. | Augier Lake | Associated with dieback of branches accompanied by resinosis. |
| | <i>Dermea</i> sp. | Babine Lake and Walcott | Associated with dieback of leaders accompanied by resinosis. |
| | <i>Phomopsis</i> sp. | Greenwood | Associated with dieback of branches. Isolated in pure culture; producing the so-called "a" and "b" spores characteristic for <i>Phomopsis</i> . |
| | <i>Scleroderma abieticola</i> Zeller & Goodding | Wells | Fruiting from needle scars; associated with dying ("flagging") of small branches. Isolated in culture. |
| Fir, amabilis | <i>Arceuthobium campylopodium</i> Engelm. | Port Moody | Causing witches' brooms and fusiform swellings of branches. Recorded previously from Oregon and Washington but apparently not from Canada on amabilis fir. |
| Fir, Douglas | <i>Botrytis cinerea</i> Pers. ex Fr. | Duncan | Causing gray mould blight of seedlings in forest nursery. |
| | <i>Cytospora</i> sp. | Sooke | Associated with a dieback disease of the leaders of young trees, probably subsequent to frost damage. |
| | <i>Flammula decorata</i> Murr. | Saanich | A gill fungus, apparently causing decay in branches. |
| | <i>Hendersonia</i> sp. | Castle Rock, Isle Pierre, Invermere, Williams Lake | A virulent and still unidentified parasite killing and fruiting on the buds of young Douglas fir. Under observation since its discovery in B.C. in 1955. |
| | <i>Phacidium infestans</i> Karst. | Peachland | Causing snow blight of Douglas fir in natural forest. Known to cause damage to snow-covered foliage of conifers in nurseries in Iowa, Oregon, B.C., and particularly in Europe. First herbarium record. |
| Fir, grand | <i>Naematoloma fasciculare</i> (Huds. ex Fr.) Karst. | Cordova Bay | Causing decay in butt log of pole-size tree cut two years previously. |
| Hemlock, mountain | <i>Melampsora epitea</i> Thüm. f. sp. <i>tsugae</i> Ziller (<i>Caecoma dubium</i> C. A. Ludwig) | Victoria | Causing a needle rust disease of hemlock. Obtained by inoculating hemlock needles with basidiospores produced by the fungus on leaves of Scouler willow. |
| Hemlock, western | <i>Dermea</i> sp. | Robertson River Valley | Associated with a dieback of the leaders of young trees. |
| | <i>Melampsora epitea</i> Thüm. f. sp. <i>tsugae</i> Ziller (<i>Caecoma dubium</i> C. A. Ludwig) | Victoria | See remarks for the same organism under mountain hemlock, above. |
| Larch, European | <i>Armillaria mellea</i> (Vahl ex Fr.) Quél. | Robertson River and Sayward | Causing root- and butt-rot and apparently killing trees 6-12 feet high in plantations. Douglas fir affected in the same manner. Identified from isolations in pure culture, no fruiting observed. |
| Maple, broadleaf | <i>Naematoloma fasciculare</i> (Huds. ex Fr.) Karst. | Cameron | Causing decay in stump. Reported on the same host from Oregon. |
| Pine, lodgepole | <i>Cenangium ferruginosum</i> Fr. ex Fr. | Houston | Associated with dieback of branches. Frequently occurring on ponderosa pine but not known to be reported on lodgepole pine in B.C. |
| | <i>Retinocylus abietis</i> (Crouan) Groves & Wells | Jordan River | Associated with resinous cankers. Reported in 1957 as causing similar symptoms in Engelmann, Sitka, and white spruce, and in alpine and Douglas fir. |

OTHER NOTEWORTHY DISEASES—Concluded

| Host | Organism | Locality | Remarks |
|--|--|--------------------------|---|
| Pine, red and Scots | <i>Armillaria mellea</i> (Vahl ex Fr.) Quél. | Bowser and Tsolum | Causing root- and butt-rot, and killing seedlings in plantations. Not fruiting; identified from isolations in pure culture. |
| Poplar, hybrid; <i>P. X canadensis</i> 'Grandis' | <i>Taphrina populina</i> Fr. | Chilliwack | Causing yellow leaf blister; previously reported on Lombardy poplar in 1958. Possibly a new world host record. |
| <i>P. X canadensis</i> 'Regenerata' | <i>Taphrina populina</i> Fr. | Haney | Same remarks as for <i>T. populina</i> on <i>P. X canadensis</i> 'Grandis'. |
| Poplar, silver | <i>Neofabraea populi</i> Thompson | Revelstoke | Apparently a virulent parasite, causing sunken-bark cankers and killing large and small branches. |
| Spruce, black | <i>Chrysomyxa ledicola</i> Lagerh. | Whitehorse, Y.T. | Causing needle-rust and -cast. Apparently not previously reported on black spruce from Yukon Territory, although known from B.C. and Alaska, where it may cause severe defoliation. |
| | <i>Chrysomyxa woronini</i> Tranz. | Dawson, Y.T. | Causing considerable damage to the current year's shoots of black and white spruce at high elevations (above 3,000 feet). First record on spruce for Yukon Territory. |
| Spruce, Sitka | <i>Retinocylus abietis</i> (Crouan) Groves & Wells | Terrace | Associated with branch cankers of living trees. In 1957 found associated with canker and dieback damage in stems and branches of living spruce, Douglas fir, and alpine fir. |
| | <i>Tryblidiopsis pinastri</i> (Fr.) Karst. | Babine Lake | Associated with dieback of lower branches. |
| Spruce, white | <i>Chrysomyxa woronini</i> Tranz. | Dawson, Y.T. | See remarks under <i>C. woronini</i> on black spruce, above. |
| | <i>Tryblidiopsis pinastri</i> (Fr.) Karst. | Smithers | Associated with dieback of lower branches of mature trees. |
| Tamarack | <i>Melampsora medusae</i> Thüm. | Fort Nelson | Causing rust and premature shedding of needles. Apparently not previously reported on tamarack in western North America. |
| Willow, Scouler and Sitka | <i>Melampsora epitea</i> Thüm. f. sp. <i>tsuage</i> Ziller | Cordova Bay and Victoria | Causing a leaf rust disease of willow. Obtained by inoculating the willow leaves with aeciospores of <i>Caecoma dubium</i> C. A. Ludwig, known to cause a needle rust disease of western hemlock. |
| Willow | <i>Diplodina salicis</i> Westd. | Cordova Bay | Associated with a dieback disease of willow. |

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